ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

VOL. XXII. No. 44.

TABLE OF CONTENTS.

Engineering News of the Week 409, 410

Technical and Illustrated Articles

Standard Frame Trestle 410
Economy in the Consumption of Timber for Railway Purposes 410
The Keystone Car Coupler 412
The First "Vignoles" Rail 414
The Design and Construction of Railway Shops (*Continued*) 414
The Quebec Land-Slide 416
Memphis Harbor Improvements 416
Garbage Disposal 416
Constitutional Provisions Relating to Irrigation in Wyoming and Montana 417
Conover's Belt Power Air Pump and Condenser 417
Elements of Weather in United States 417
The Quebec Land-Slide 418
The Channel Bridge of Messrs. Schneider and Hersent 423
Express Trains in Germany and on the Continent 424
Railway Traffic Associations and Interstate Commerce Law 424
Department of Public Works of France at the Exposition 424
Train Electric Lighting 424
Underground Temperature 425
A Manual of Railway Field-Work and Laying Out of Works (*Continued*) 426
The Resistance of Ships in Narrow Channels 427

Personals, Book Reviews, Publications Received.

Society Proceedings 418, 419

Editorials and Editorial Notes 420, 421

Aluminum or Aluminium.—Price of Aluminum.—The Meaning of Trade.—Trade of the World.—Matter of Private Interest in Society Publications.—Patents and Professional Men.—Panama Canal.—Effects of Bad Roads.

The Progress of Railway Consolidation 421

Correspondence

The Duty Test of the Pearsall Hydraulic Engine 422
The Work of Traffic Associations 422
A Faulty Roof Plan 422

Notes and Queries 423

Railways, Rapid Transit, Highways, Contracting, Proposals Open, Manufacturing and Technical, Bridges and Canals, Electrical, Sewerage and Municipal, Water-Works ..... 427—432

ENGINEERING NEWS.

THE UNION PACIFIC and the Chicago & Northwestern Companies have entered into a ten-year traffic contract with each other, which is likely to prove a factor of much importance in Western railway matters. The contract provides for joint tariffs, division of earnings from through traffic, the establishment of rates under competition, joint through trains, and that no competitor shall be given advantage over the parties to the agreement. The through line via Sioux City is to be known as the Lake Superior, St. Paul & Union Pacific route. The through line via Council Bluffs will be known as the Chicago, Union Pacific & Northwestern line. The practical effect of the agreement is to consolidate the two systems, so far as through traffic is concerned, giving the Union Pacific much-needed terminals at Chicago, St. Paul, and Lake Superior ports, and giving the Chicago & Northwestern Company access to Kansas, Colorado, Utah, and the far Northwest. No secret is made of the fact that the agreements are to be extended to cover the Vanderbilt systems east of Chicago, so that through trains will be run from ocean to ocean.

A thirty-six mile link is at once to be built in Eastern Wyoming, connecting the Cheyenne & Northern branch of the Union Pacific with the Wyoming Central extension of the Chicago & Northwestern systems, but the companies are to refrain from any encroachment on each other's territory. The agreement does not involve a financial consolidation in any sense. It is properly an alliance between the two great companies for mutual defence and aid, and it is pretty certain that it will be followed by similar alliances among the systems lying west of Chicago.

Mr. GEORGE WESTINGHOUSE, of Pittsburg, has just concluded the purchase of some valuable copper mines in Washington Camp, Arizona, the product of which will be used at the works of the Westinghouse Electric Co. An application for the charter of the Duquesne Mining and Reduction Company will be made, Nov. 20, the incorporators being GEORGE WESTINGHOUSE, Jr., CHARLES A. ASHBURNER, JOHN CALDWELL, H. H. WESTINGHOUSE, and WALTER D. UPTEGRAFF. The electric company uses several million pounds of copper every year in the manufacture of electrical machinery, and by having its own mines the saving in profits which would otherwise be paid to the copper ring in excess of the legitimate cost of production is expected to amount to a considerable sum each year. The mine will give employment to about 300 men. Mr. CHAS. A. ASHBURNER, the geologist, will personally superintend the work of starting the mine.

LEAGUE ISLAND is reported upon favorably by the board of naval officers appointed to examine into its permanent improvement as a navy yard. This station now has an area of 923 acres. The ground is an alluvial deposit, varying in thickness from 16 to 55 ft. below mean low water, resting upon a bed of gravel,—a favorable formation for dock building. The yard would be 90 miles from the sea, impregnable to naval attack, and salt water never reaches it. The board recommends that it should be equipped with all facilities and appliances for building, repairing, and fitting out all kinds of war-ships. The estimated cost of so doing is about $14,000,000.

THE AMERICAN FORESTRY ASSOCIATION has been practically reorganized, and under its amended constitution is likely to have increased power and influence in advancing legislative and other methods for the preservation of the forests, in the interest of the timber resources and the regulation of the rainfall, atmospheric conditions, and water supplies in certain sections of the country. A report of the annual meeting was given in our issue of last week. A vice-president is to be chosen from each State and Territory, one from Canada, and possibly one from Mexico; this will extend the field of the association's influence. A large increase in the membership is desired; annual dues, $2. For particulars address Dr. H. M. FISHER, 919 Walnut St., Philadelphia, Pa.

THE MANHATTAN ELEVATED CO., according to what is yet mere rumor, proposes to lengthen its station platforms to accommodate seven-car trains, to build heavier locomotives, and to flatten out the sharp curves on the Sixth Avenue line by buying more property. To do this, and to liquidate claims for damages, $20,000,000 is to be raised. Included in this plan is the acquisition of more territory for terminals, etc.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was a rear collision, Oct. 22, on the Louisville & Nashville Railroad at Nolin Station. An accommodation train was just starting, and was being pushed by its engine, the train having been turned round in switching past a wreck, when a southbound express ran into it. The engine driver of the express train had just time to reverse his engine and apply the brakes before the collision occurred; both engines were wrecked, and three cars of the accommodation train were damaged, one being telescoped. There was one passenger killed and about twenty more or less seriously injured. The accident occurred on a single track line, and the accommodation train is usually sidetracked to let the express pass; the former, however, was behind time, but no flagman had been sent back. The principal blame, however, is said to rest with the train dispatcher. ——Two more serious collisions are reported: one was a head collision on the Chicago, Milwaukee & St. Paul, Oct. 28, near Glendale, Ia., between a passenger and freight train. It is said that the engineer of the former, who was killed, was drunk, and persisted in racing with a Rock Island train on a parallel track, instead of stopping at Glendale. The wreck caught fire and one man was burned to death and about fifteen persons were injured. The other accident was a rear collision on the Baltimore & Ohio, near Canton, Md., Oct. 29; a passenger train ran into two flat cars drawn by an engine, and the train narrowly escaped going over the embankment.——A fast freight train jumped the track at the Main St. crossing at Rahway, N. J., Oct. 28; 15 cars were wrecked and several persons injured.—— The boiler of a Louisville & Nashville locomotive exploded Oct. 23 near Faxon, Tenn.; the engine was used for hauling a construction train and was standing still at the time.

THE FOLLOWING BRIDGE ACCIDENTS are reported: A railway bridge over the Skunk River between Nevada and Ames, Ia., was partly destroyed by fire on Oct. 25.——The railway bridge of the Cambria Iron Co., at Johnstown, Pa., has been damaged by the flood in the river this week, and the public bridge over the Conemaugh has also been damaged.

AN AMERICAN "EIFFEL TOWER" has been proposed by Mr W. L. JUDSON which would be 1,600 ft. high on a base 400 ft. in diameter. The design includes a double circle of twelve heavy latticed posts with a roadway about 75 ft. wide between the circles. This road ascends, with an 8 per cent. grade, to the top of the tower and would be 3.76 miles long. Two systems of spirals are contemplated, one for a driveway and the other for a line of tramcars propelled by the Judson or some equally good system. The interior of the tower would be open excepting for ten floors, 275 ft. in diameter each, which would be utilized for hotels, restaurants, etc. The estimated cost is $2,500,000 and it is said that the Phœnix Bridge Co. stands ready to contract for it at that price and take a large block of stock in part payment.

THE PRICE OF ALUMINUM was reduced last week, by the Pittsburg Reduction Co., as follows: In the form of ingots, 1,000-lb. lots at $2 per lb.; 500-lb. lots at $2.25; 100-lb. lots at $2.50; 50-lb. lots at $3, and small quantities at $4 per lb. But very recently the lowest price quoted was $4 per lb., and within the year it was $6. This offer plainly indicates that if the demand will warrant, as it surely must in a short time, the lowest price above quoted would rule, and that even this price can be again reduced as the processes of reduction are perfected and the market widened.

MISSISSIPPI STATE LEVEES, to the extent of 869 000 cu. yds., have been contracted for in 1889. This is 250,000 cu. yds. more than in 1888. At the present rate of building, two years more will complete the work in this State. This money is raised by a tax on cotton and other products. The average cost of levee making in the Greenville district is 14½ cts. per cu. yd., including some heavy and difficult work. Many of the levees were let as low as 6 and 10 cts per cu. yd. It is only about fifteen years ago that 25 to 30 cts. per yd. was considered cheap, and much of the work of that day cost 40 and 50 cts.

THE MISSOURI STATE GEOLOGICAL SURVEY has been commenced by Prof. ARTHUR WINSLOW, the lately elected State Geologist. He has practically a clear field, as previous work in this direction is of a very meagre nature. The United States topographical survey covers but a small fraction of the mineral bearing lands of the State. The first points to be investigated will be the lead and zinc deposits, the coal fields, the building stones, clays, and sands, of Missouri.

A GEOLOGICAL SURVEY BILL has been passed by the Legislature of Georgia, and as a consequence the office of State Geologist is to be revived. This is a long step toward the better development of the resources of that State.

EXTRALITE, A NEW EXPLOSIVE, was tested in this city last week. It is the invention of RUDOLPH ERICSSON, and is said to be compounded of an ammoniacal salt, a hydrocarbon, and chlorate of potash. It was proven to be safe in handling by throwing four broken packages on an open fire, where it burned rapidly with a hissing sound; it was also pounded on a rock, and a cap and fuse were attached to a cartridge and fired without setting off the cartridge. Three holes were then drilled in the rock, and one 18 ins. deep was loaded with 8 ozs. of the extralite, and in each of the other 12-in. holes, 4 ozs. of the powder were placed, and all well rammed. These three charges were fired together by caps and a wire. The effect was to shatter large masses of the rock rather than to crush smaller portions, and the test was generally satisfactory.

THE FORTH BRIDGE was coupled-up at the lower chord of the connecting girder of the south span on Oct. 10. A 1,700-ft. bridge is now an established fact, and this Scotch bridge span is the longest in the world. The two arms of this bridge, which spring from piers 1,700 ft. apart, met on a perfect level, but as the temperature was not as high as was expected, the rivet-holes in the chords and connecting plates were ⅜ in. apart on the west side, the side exposed to the sun, and 1 in. apart on the other. The holes in the western chord were brought fair by a hydraulic jack and riveted. On the east side, however, the pull of 170 tons failed to bring the holes nearer than ⅛ in.; the girder was then

heated by placing waste soaked in naphtha in the trough of the girder, and firing it. This expedient was finally successful. The top chords were joined without any material difficulty. In the other 1700-ft. span, the gap has been reduced to 60 ft.; but a temporary gangway makes it possible to traverse the whole length of the bridge.

A 350-FT. STACK has been completed by the Fall River Iron Co. at Fall River, Mass. It is 350 ft. high from top of foundation to top of cap, with a bottom diameter of 30 ft. and top diameter of 21 ft. The flue is 11 ft. in diameter throughout. The foundation is made of granite and is 55 by 30 ft. by 16 ft. deep. In the construction of this stack 1,700,000 bricks were used, 2,000 tons of stone, and 2,000 barrels of Portland cement mortar. The estimated cost is $40,000. The cap is terra cotta in 128 sections. Ground was broken on April 6; brick-laying commenced June 5, and it was finished Oct. 25. The next tallest stack in this country is that of 335 ft. at the Clark Thread Works, at Kearny, N. J. Mr. WM. M. MANLEY was the builder of the Fall River stack.

THE CAIRO BRIDGE, carrying the Illinois Central R. R. across the Ohio River at that point, was formally and successfully tested, on Oct. 29, by sending over it a train of nine mogul engines aggregating in weight nearly 700 tons. These were followed by a special train carrying officials of the road, engineers and guests. This bridge was built by the Union Bridge Co., of New York, with Mr. ALFRED NOBLE as engineer in charge.

THE CHILIAN GOVERNMENT has removed the duty on agricultural implements, telephones, iron and steel rails and other articles. The law is to take effect on Jan. 1, 1890.

A KRUPP GUN-PLANT IN PITTSBURG is reported as being a possibility; but it is as yet a report with seemingly little foundation. As stated, the present Herr KRUPP is negotiating for the purchase of land on the Monongahela River for the purpose of transferring his entire plant to this neutral country, whence guns could be supplied to the whole fighting world.

A DETROIT RIVER TUNNEL is projected by Mr. LUTHER BEECHER, to cost $3,500,000. It is to be constructed in an entirely different manner from that started by the same man eight months ago, and stopped by the Michigan Central R. R. Co. Unintelligible press accounts speak of "a monstrous steam ram" that Mr. BEECHER has patented for ramming his way under the river and through corporate obstructions.

THE CANADA ATLANTIC CABLE will be 1,900 miles long and will cost $1,500,000. Its promoters are said to have completed all arrangements for laying this cable between Clew Bay, Ireland, and Greenly Island, in the Straits of Belle Isle, where it will connect with land lines.

ELECTRIC LIGHT FOR CHINA is to be furnished by the Westinghouse Electric Light Co. which has secured the contract to erect a central station for a very large electric light plant in Pekin. The machinery has been shipped. The city is to be lighted throughout with incandescent lamps, whose number runs into many thousands. Electric men consider this a great triumph for America, because the competition with European companies was very keen.

THE GULF DEEP HARBOR Board of Engineers has completed its survey of the northwest corner of the Gulf of Mexico, to determine the best location for a deep water harbor, and is now engaged on the report, which will probably be ready in a month. The board consists of Lieutenant-Colonels H. M. ROBERTS, G. L. GILLESPIE, and J. A. SMITH.

THE NEW GUN FOUNDRY AT WATERVLIET ARSENAL will be completed, as to its masonry, this fall. The beams and columns for the overhead cranes are being set and work generally is being pushed with considerable vigor.

THE 12-IN. STEEL-HOOPED, CAST-IRON MORTAR, at Sandy Hook, has been fired 225 times, with pressures reaching 33,000 lbs. per sq. in., says a Washington exchange. The unhooped cast-iron mortar, recently tried at the same place, completely failed. The scheme of the fortification board included the mounting of 724 of these 12 and 10-in. mortars at the various Atlantic and lake ports, but the only specimen of these mortars existing to-day is the one referred to at Sandy Hook. But contracts have already been given out, we understand, for a number of the steel-hooped type that has so successfully stood the firing test. Its range was six miles.

THE SUMMIT TUNNEL ON THE TRANSANDINE RAILWAY, says London *Engineering*, will be at the Uspallata or Cumbre Pass. This tunnel will be 3.1 miles long with a rail elevation of 10,450 ft. above the sea. This is on the line, 871 miles long, which is to connect Buenos Ayres and Valparaiso, of which 149 miles is yet to be built. This elevation far exceeds the height reached by any European tunnel, as the Rigi Railway attains an elevation above sea level of 5,753 ft. and the St. Gothard only 3,788 ft. But the Climax Tunnel, on the Denver & Rio Grande Railroad, near Leadville, Col., is 11,792 ft. above sea level, and the Alicante Tunnel, near it, is 11,197 ft. high. The summit tunnel on the Peruvian-Andes Railroad, as located, would be 15,672 ft. above sea level.

THE LOS ANGELES SEWAGE DISPOSAL, on land, seems to be a success. The Sewage Commission lately visited the farmers now using the sewage for irrigation purposes, and they were told by one large proprietor that his land now rented for $22 per acre, whereas it was not worth $2 rent previously. The sewage was conducted over the properties in open ditches; yet no bad odors were complained of and the region is claimed to be exceptionally healthy.

THE LOUISVILLE AND JEFFERSONVILLE BRIDGE PLAN, as revised, has been approved by the Secretary of War, and Mr. DENNIS LONG, one of the chief promoters of the bridge, says that the contract was let to the Phœnix Bridge Co. five months ago, and that the contract calls for completion within eighteen months from the start. Work is already commenced, and will be pushed. The three main channel spans will be 550 ft. each, and the length of bridge from shore to shore will be 1,650 ft., or including approaches, 8,800 ft. The head room for steamer at high water is 53 ft. Mr. RANDOLPH, the former engineer of the Chesapeake & Ohio railway bridge at Cincinnati, is the chief engineer of the present company.

TEN JULIEN ELECTRIC CARS were taken from service on the Fourth Avenue surface road in this city this week, owing to an adverse decision in the U. S. court by Judge E. HENRY LACOMBE. This decision held that the Julien Company infringed a patent belonging to the Electrical Accumulator Company by applying the active layer to the plates in the form of a paste before the plates were immersed in the finid.

ILLEGAL STREET EXCAVATIONS in Washington, D. C., have called forth a report from Capt. LUSK, U. S. Eng's. He directs attention to the fact that the inspector of buildings issues permits for the construction of buildings and vaults under the sidewalks at all seasons of the year; but an old law still in force forbids excavations in the streets, sidewalks, and avenues of the city between Nov. 1 and March 1 of the next year. This law has never been strictly enforced, and for two years past it has been amended by the District Commissioners so as to read from Dec. 1 to March 1. On receiving Capt. LUSK's report, the commissioners submitted the question to the city attorney, and this official answers that "the building regulations have the full force of an act of Congress so declared by Congress itself, and they set aside, annul, and repeal all former laws, acts, and parts of acts inconsistent with them or any of them." The commissioners will probably issue new regulations.

Standard Frame Trestle, Cleveland & Canton Railroad.

The trestle here illustrated was devised by Mr. H. A. KENNEDY, Chief Engineer of the Cleveland & Canton R. R. As will be seen from the plan, timbers 6 in. x 12 in. are used in the construction of the posts, caps, and sills. Mr. KENNEDY claims for this innovation that the caps, sills, and posts, being thus made up of two pieces packed together, will last from one to two years longer than if solid pieces were used in the same place. The thinner timbers are better seasoned and less liable to rot than the solid member of large size, which is too often left until there is merely an outside shell of sound wood to do the work required.

The peculiarity of construction is that neither corbels nor drift bolts are used, and the stringers, instead of being bolted to the caps, are held in place laterally by 3-in. blocks fastened by lag-screws. This trestle has been designed so as to make the work of repair as easy as possible, and to reduce it to a minimum, and the design certainly has points worthy of attention, although we are not prepared to altogether approve of it.

Economy in the Consumption of Timber for Railway Purposes.*

That railways are responsible for a very large amount of the consumption of timber in this country is an axiom; to reduce this consumption effectively is one of the problems of the forestry policy. The subject of economy in the consumption of timber for railway purposes is an extensive one, as railways consume such large quantities of timber and for so many purposes, but the very diversity of these purposes enables several methods of economy in different ways to be suggested. The present railway mileage of the United States is about 160,000 miles, increasing by about 3,000 to 12,000 miles of new road every year; and while these few thousand miles of new road require timber for construction, the 160,000 miles also require large quantities for renewals and repairs. As the railway systems extend, they consume timber for bridges and trestles, ties, buildings, etc., and the existing lines also consume timber in the maintenance and renewals of the same kind of works.

To a great extent, wood is now used because it has been used from early days, and its use has become a custom. In the early days of the settlement of America, when the "forest primeval" was the predominating feature of the country to the settlers, and the "backwoods" was a location not far from the coast, timber was a material put to every available use, and rightly so, as it was the material most convenient and most abundant, and was in fact the only material for buildings fuel, etc. So in the early days of railways, wood was the only material practically available, and was used for ties, rails, trestles, buildings, fuel, etc. Iron and steel, brick and stone, concrete, coal, etc., were not then available. The effect of this consumption upon the forestry resources was scarcely appreciable; but at the present time, when the forests are being attacked on every side, and at their very centers, the destruction of these resources assumes alarming proportions. The present existing supply of timber of the United States is of course very large, and probably no actual famine is imminent; but while this actual scarcity of timber may be far off, the evil results of forest destruction upon the climate and atmospheric conditions are being already demonstrated. Besides this, the prices of some of the best woods are increasing with the reduction of the supply; it is said that the redwood of California is disappearing rapidly, and that, as it is only found on that part of the Pacific coast, it will soon be as rare as the buffalo of the plains.

There should be some means of regulating the cutting of timber, to check the present wasteful and reckless methods and to prevent the illegal cutting over State lands. Steps should also be taken with a view to a practical system of re-forestation, a matter which is too little considered. Even the timber trade journals have of late been counseling caution in the cutting and consumption of timber, and suggesting steps for re-forestation. The work of the railways in destroying timber and forests, and in illegal cutting, should also be checked, as well as their misdeeds in causing forest fires.

The spoliation of the Adirondacks is shown by the report of the Forestry Commissioners of New York State, and by a recent series of articles published in the New York *Times*; these articles have been written on the spot during a personal investigation of the existing conditions and prospects, and make a very powerful presentment of the work being carried on, wastefully and illegally, and of the general apathy and indifference of the people and the constituted authorities to the destructive work. It is encouraging to find a daily paper of such reputation taking up the matter in this way, and it is to be wished that some practical results might follow upon this outspoken denunciation of the forest vandalism; past experience, however, of such missionary work does not conduce to enthusiastic hopes of such practical results, but the work should be continued and backed up by this Association and its members, so as to make the

* A paper by E. E. RUSSELL TRATMAN, presented at the American Forestry Congress, Philadelphia, Pa. Oct. 17, 1889.

forestry question a live issue, and keep it steadily before the public and the legislators, thus aiding the establishment of a national forestry policy.

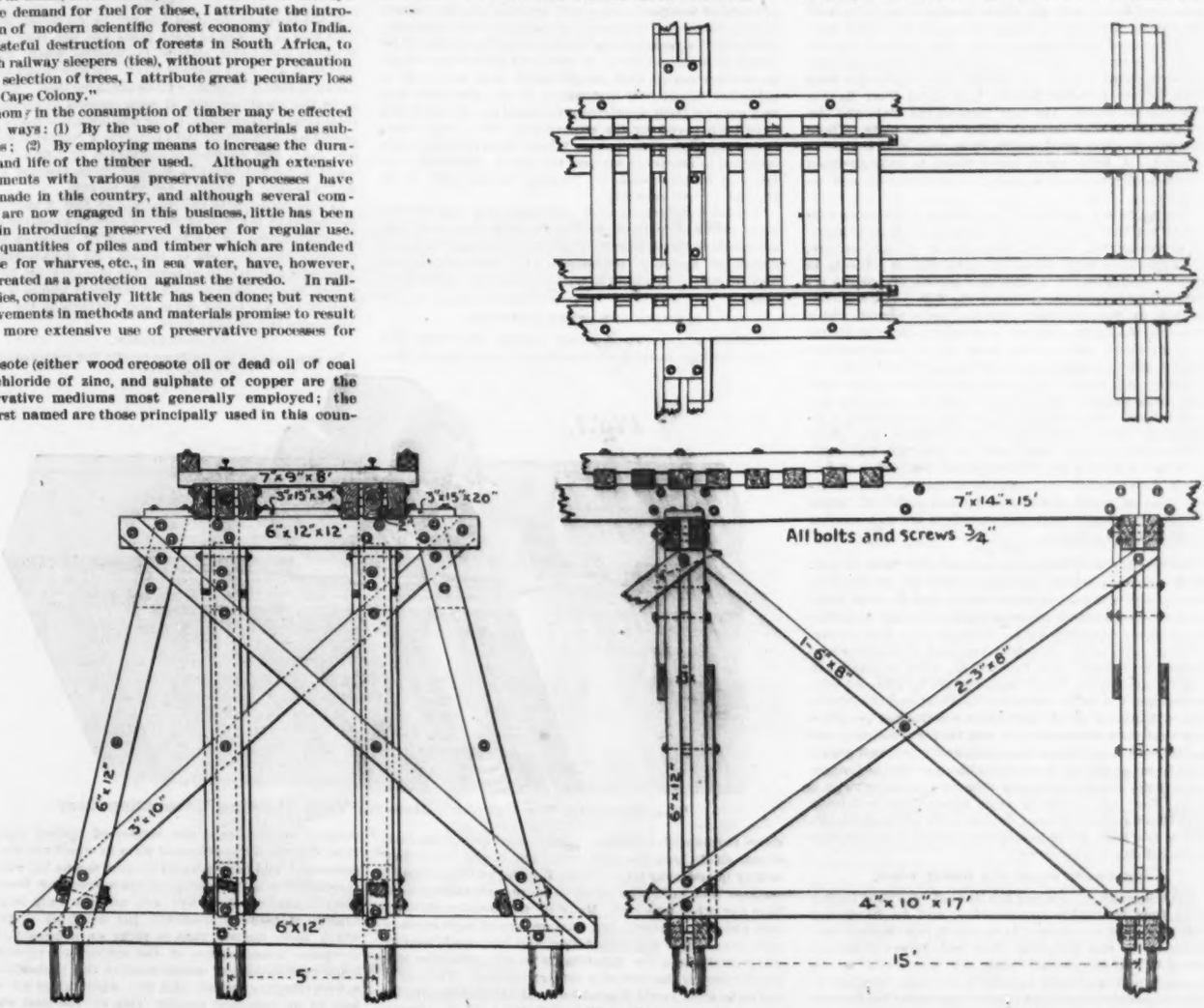
In New Hampshire, the purchase of mountain timber lands by the State is contemplated, for the benefit of the water supply, and for the sake of the attractive scenery. The acquisition of the Adirondack region by the State of New York, and the adoption of a rigorous forestry policy, would be a wise and judicious step.

The following extract from a letter to me from Dr. Brown, of England, the well-known authority on forest subjects, and the writer of several works on these subjects, is a very significant comment upon the relation of railways to forestry. He says: "To the destruction of forests in India, occasioned by the formation of railways and the demand for fuel for these, I attribute the introduction of modern scientific forest economy into India. To wasteful destruction of forests in South Africa, to furnish railway sleepers (ties), without proper precaution in the selection of trees, I attribute great pecuniary loss to the Cape Colony."

Economy in the consumption of timber may be effected in two ways: (1) By the use of other materials as substitutes; (2) By employing means to increase the durability and life of the timber used. Although extensive experiments with various preservative processes have been made in this country, and although several companies are now engaged in this business, little has been done in introducing preserved timber for regular use. Large quantities of piles and timber which are intended for use for wharves, etc., in sea water, have, however, been treated as a protection against the teredo. In railway ties, comparatively little has been done; but recent improvements in methods and materials promise to result in the more extensive use of preservative processes for ties.

Creosote (either wood creosote oil or dead oil of coal tar), chloride of zinc, and sulphate of copper are the preservative mediums most generally employed; the two first named are those principally used in this country. The Chicago Tie Preserving Co., at its own works, (which supply ties for the Chicago, Rock Island & Pacific Railway, under contract) and at the works erected by it at Laramie, Wyo., for the Union Pacific Railway, and at Las Vegas, N. M., for the Atchison, Topeka & Santa Fé Railway, uses the zinc process; the Southern Pacific Railway has both creosote and zinc plants at its Houston works; the Creosote Lumber Construction Co., of Fernandina, Fla., and the Carolina Oil & Creosote Co., of Wilmington, N. C., use the wood creosote oil; the Lehigh Valley Creosoting Co., of Perth Amboy, N. J., Eppinger & Russell of New York, and the Old Dominion Creosoting Works, of Norfolk, Va., use dead oil of coal tar; the Louisville & Nashville Railway has a creosoting plant of its own, used for piles and timber; the Boston & Maine Railway has a kyanizing (corrosive sublimate) plant at Portsmouth, N. H., which has been used for treating hemlock ties; the Wood Vulcanizing Co., of New York, has a novel process by which the natural acids of the wood are claimed to be solidified and retained in the wood, increasing its hardness and durability. In Europe the experience with preserved ties has been very satisfactory, and such ties are almost universally used. Creosoting is the process generally employed and creosoted oak and beech ties used on one of the railway systems in France are reported to have an average life of 25 years, while some are in good condition after that period.

The different effects of the different preservatives must be taken into consideration, as what may be good for timber to be used under some conditions, may be bad for that to be used under other conditions. Thus creosoting is found to soften the fibres of the wood, so that for ties in this country, there would be little benefit, as the present rapid cutting by the rail flange would be increased, unless metal tie plates were used to distribute the pressure over a larger area of the tie. In foreign countries, where the rails are usually carried in cast-iron chairs with wide bases, this objection does not obtain, and creosoted ties are there very generally used, and with excellent results. Other methods of treatment, such as the use of metallic salts, are found to harden the wood, and such methods are of course more suited for ties, while creosoting may be well adapted for timber for other purposes. In any case the operations must be carefully and thoroughly carried out, if really efficient results are to be obtained.



Standard Frame Trestle; Cleveland & Canton R. R.

Railway companies consume timber principally for the following purposes, in most of which economy can be effected with benefit to the companies.

1. Ties.
2. Fences.
3. Telegraph poles and signal posts.
4. Bridges, trestles, and culverts.
5. Stations and other buildings.
6. Rolling stock.
7. Fuel.

TIES.

The following figures will serve to show the importance of this branch of the subject. Taking the present extent of railways in the United States at 160,000 miles, and estimating an average of 2,500 ties per mile, which is a reasonably low figure, the number in many cases being from 2,600 to 2,800 or even 3,000 per mile, this gives a total of 400,000,000 ties in actual use, while at an average life of 8 years, 50,000,000 ties will be required annually for renewals. Averaging the annual new construction at 5,000 miles, adds 12,500,000 ties annually to the number in use, and also adds 1,562,500 ties to the number required annually for renewals. These figures are exclusive of the consumption of ties and stringers for street railways, a by no means insignificant item. Calculations of this kind are not, however, of much value, except to present clearly the great extent of the timber consumption for one item alone. The important points for each railway company are not the averages for the whole country, or the whole railway system, but are the average consumption, life, and cost upon its own lines. As an example of some individual cases I give the following figures, taken from the annual reports of the railway companies: New York, Lake Erie & Western, 1887; 934,420 ties laid and 249,375 on the New York, Pennsylvania & Ohio, Old Colony, 1888; 315,000 new ties, 25,371 being for new second track. Michigan Central, 1888; 723,065 ties replaced. Baltimore & Ohio, 1888; 230,315 on Western division, and, 609,402 on Eastern division. Illinois Central, 1886; 654,141 ties. Missouri Pacific, 1888; 1,465,121 ties. The New York Central & Hudson River Ry. consumes about 800,000 ties per annum for renewals.

The consumption of timber ties may be reduced either by the use of means to increase their life, or by abandoning wood for more durable material.

Increasing the life of wooden ties may be effected by the use of preservative processes, or by the use of metal tie-plates to distribute the load on the rail over a greater area of the tie than that covered by the rail flange. In this country the best results would probably be obtained by combining these two methods, as so much trouble is experienced from the narrow base or flange of the rails cutting into the wood. On some roads the ties have to be taken out of the track for this cause before they have begun to decay. The life of ties averages probably about eight years, in some cases as low as five or six, but their life in service is frequently limited by their resistance to the cutting action of the rail flange rather than by their natural life or resistance to decay. A preservative process, therefore, which softens the wood, is of little value for ties, unless the tie-plates are used; but the most serviceable and valuable process would be one

that hardens the wood as well as protects it against decay. As previously noted, some railways have already recognized the advantages of using preserved ties, and as experienced men and engineers have now turned their attention to the different processes, and have shown that successful work can be done, the use of such ties will probably become more general, especially as the increasing traffic increases the rate of cutting of the ties. There has been until quite recently a general indifference on the part of the railway men, and the extra cost is, of course, an obstacle, as railway directors, like too many people nowadays, often prefer cheapness of first cost to subsequent economy.

In regard to the use of tie-plates, these are being quite extensively adopted. In Europe they are generally large and heavy, and are often used in connection with improved fastenings. Some plates of this kind have been designed and brought out in this country, but the form of plate now generally used here is a shallow channel iron about 8 x 3⅝ ins. square, with the longer sides turned down, forming flanges ⅝ in. deep; these flanges bite into the wood. The rail rests on the plate and the spikes are driven through holes in the plate. These plates have given good results in service and are inexpensive. A little extra expenditure in this direction effects a very material economy in maintenance and renewals.

Coming to the question of substitutes for wooden ties, I may say that for about two years I have been engaged in investigating, for the Department of Agriculture, the experience with the use of metal ties on railways in foreign countries. A preliminary report, giving the results of my investigation during the first year, was submitted in February last, and the main report, which will describe the various systems tried, is now in course of completion. Steel is the metal which gives the best results, and is most extensively used, although cast-iron bowls are still used in India and South America with sand and earth ballast. The extent to which metal ties are used is quite astonishing, and their use is continually increasing. The railway track of the future will probably consist of heavy steel rails on steel ties, but while looking for such a desirable form of track, the advantages of increasing the durability and safety of the present form of track should not be lost sight of. Metal tracks for street railways are already in use on a number of lines in this country.

FENCES.

The fencing in of the tracks having only become general in the more thickly populated parts of the country, and within very recent years, this is not a very large item in the consumption, especially as old or worthless material is frequently used. Wire fencing is, however, coming into more extensive use and at stations iron fencing is the best. For fencing in open country the English system of hedge fences might be adopted with advantage. A ditch is dug and the material thrown up into a bank, on which the bushes are planted in such a way that they will interlace; the bushes are strong and hardy, with very tough branches, and when well grown they form an almost impassable barrier. The hedges require little attention except trimming once or twice a year. They are certainly more pleasant to look upon than the dilapidated fences, daubed with advertisements, which are such an objectionable feature of the railway landscapes in this country.

TELEGRAPH POLES AND SIGNAL POSTS.

The telegraph poles along the lines of railways form a large item in timber consumption, and an important item in regard to forestry, as each pole represents a tree. Economy in this direction does not, however, appear probable. Underground lines are not likely to be adopted, and although tubular iron poles, similar to those sometimes employed to carry the wires for electric railways in cities, have been suggested, no steps have been taken to introduce them. The life of the wooden poles might be increased by preserving the wood, charring the bottom, or painting or whitewashing the pole, but very little care is generally paid to them.

With the increase of the extent of signalling systems, which marks a great improvement in railway practice in this country, the use of wood for posts increases, but as these posts are generally painted and looked after, their life is probably longer than that of the telegraph poles. Metal posts are used to some extent, principally on city elevated railways, but wood continues to be the material used for ordinary purposes.

BRIDGES, TRESTLES, AND CULVERTS.

The days of wooden railway bridges may be said to have almost passed away, for although many are still in use and some new ones are built, principally in the West, yet the general tendency is to employ iron, steel, or stone for new bridges, and to gradually replace wooden bridges with others of more durable material.

The use of trestle work, however, is carried to too great an extent in this country, the reason being that in many places it is cheaper and quicker to build a trestle than to build a culvert and fill in a solid bank. The use of these trestles, and still more their style of construction, is to be deplored. In too many instances, very little attention is given to their design, and they are built rapidly and roughly. As long as railways are built rapidly and cheaply to develop traffic in new districts, so long will trestles continue to be used, and for such structures no material is so cheap, handy, and workable as wood. If railways would replace these structures with something more solid, as fast as they are able, it would be a good thing; but as a rule, the filling in to solid bank is postponed indefinitely, while money is constantly being spent on minor repairs and general maintenance, or, what is worse, the structures are left without any attention. Iron trestle work has been used for long, high viaducts, but its use for the ordinary class of trestles is very improbable, one of the principal objects of these trestles being to insure cheapness in construction.

Numbers of accidents are caused every year by the burning of wooden bridges and trestles, and the failure of the latter by weakened or washed out supports. Where such structures are in use, especial care should be taken to maintain them in safe and proper condition, as carelessness in such maintenance may cause, as it often has caused, the destruction of the structure and perhaps of a train, involving a financial loss which might have been saved by the expenditure of a little care, money, and labor in repairs. Where these structures are intended to remain in service, the use of preserved timber and of whitewash or fireproof paints will be in the line of true economy.

Wooden culverts are still employed, but iron and cement pipe are being more and more widely used, and are much to be preferred. For large openings, masonry arches or masonry abutments with iron roof beams may be used. Concrete is also adapted for use in such cases.

STATIONS AND OTHER BUILDINGS.

There is a growing tendency among the larger and more wealthy railway corporations to put money into more permanent buildings. Brick and stone stations, shops, sheds, roundhouses, etc., are being built, but mainly in and near large cities; for the smaller class of stations and buildings, wood is more extensively used than any other material. Many of the wooden stations now existing at towns and villages are of poor appearance, inadequate accommodation, and bad condition; in many such cases the inhabitants would subscribe liberally towards the cost of a better building. The material to be used would depend on local circumstances. In some places stone is readily available, brick is almost always obtainable at reasonable prices, while in some cases perhaps concrete or iron (galvanized iron sheeting on iron framing) might be used. The same remarks apply to freight sheds, shops, roundhouses, car sheds, etc.

The principal economy to be effected in this direction, as regards the consumption of timber, is in the use of other materials than wood in the first construction of the buildings, as when once built of wood, the amount consumed for repairs is not large. In substituting a permanent structure for a wooden structure, the railway company would, however, effect an economy in maintenance expenses.

ROLLING STOCK.

Within the last few years, metal has come to be used to some extent in the construction of rolling stock, principally in car frames and truck frames. Several suggestions have also been made as to the construction of cars of steel throughout, and some few sample cars of this kind have been built by different companies. A mail car built entirely of steel, on a plan patented by Mr. GREEN, was put in actual service on the Louisville, New Albany & Chicago Railway (Monon Route) some time in 1888, and Mr. WATKEYS, the Master-Mechanic of the road, informed me in September last that the car is still in use and has given satisfactory results. He stated that up to Sept. 26, it had made about 88,000 miles and had not cost anything for repairs. The cars on the experimental line of the Meigs elevated railway at Cambridge, Mass., are of metal throughout; the truck and floor frames are of iron and steel, and the body has transverse ribs or frames of metal tubes with sheet metal panels. Freight cars with metal frames are already used quite largely. While it is not probable that cars built entirely of metal will be extensively adopted for a good many years to come, yet there is certainly reason to hope and expect that the use of metal framing will be very rapidly extended. This will cause a considerable reduction in the consumption of timber, and timber of the best kind, for car work, and it will also result in a decided cash economy to the railway companies, the cars lasting longer and costing less for maintenance and repairs than cars built entirely of wood.

FUEL.

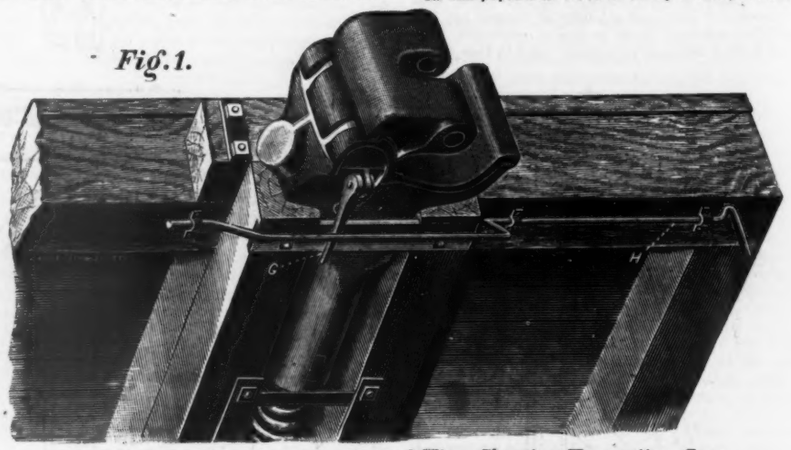
Wood-burning locomotives are by no means so common now as they were some years ago, but they are still in quite extensive service in regions where wood is plentiful, and coal perhaps dear. In New England they are to be found on some of the northern lines. Statistics as to the total number of such engines in service, and their total consumption, is not available, but the monthly performance sheet of the Louisville & Nashville Railway for July, 1889, shows a consumption of 1,823.6 cords of wood for wood-burning engines, at an average cost of $1.77 per cord, or $3,229.77 for the month.

In connection with the question of fuel, it may be remarked that the use of efficient spark arresters should be compulsory on the locomotives of railways passing through timber lands or forests. At the present time the spark arresters in general use are very far from efficient, as may easily be seen by travelers, and as is clearly proved by the burnt strips and patches of the woods bordering the railway lines.

CONCLUSION.

In this paper I have shown briefly the responsibility of railway companies in the matter of timber consumption, described the principal ways in which the timber is consumed, and have suggested some means by which the consumption may be reduced, with resulting benefit to the companies. Railways are not the only large consumers who are responsible for using or destroying much more timber than is right or necessary, but a complete consideration of the subject of economy in timber consumption would involve the preparation of a very lengthy paper, and one which after all might lead to no practical results. One of the best ways in which the cause of forestry, as advocated by the American Forestry Association, can be advanced and strengthened is by a steady agitation of the subject and importunity for the desired legislation, so that the exigencies of the case may be comprehended by and kept in the minds of the people and their representative authorities, and I have tried to have a part in the good work by the preparation of this paper on economy in the consumption of timber for railway purposes.

Fig. 1.



The Keystone Car Coupler. General View Showing Uncoupling Gear.

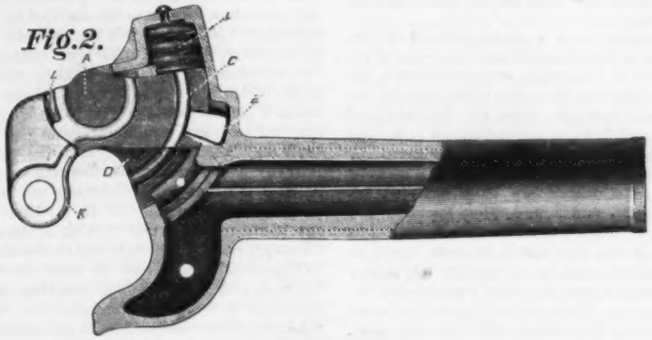
The Keystone Car Coupler.

While the fearful flood of couplers of all kinds and types which used to deluge the technical papers of the country is no longer poured out, or at least never gets further than the Patent Office storage reservoir, the making of couplers of the now standard M. C. B. type is by no means over, and possibly never will be over, for the standardized features of the coupler admit of a very great variety of details for carrying them out. The Keystone coupler, illustrated herewith, is one of the newest evidences of this fact, it being claimed to have three advantages in its favor: 1. Relief of the knuckle from breaking strains; 2. A more effective

uncoupling device; 3. Greater durability from having a renewable wearing face for the inside of the knuckle.

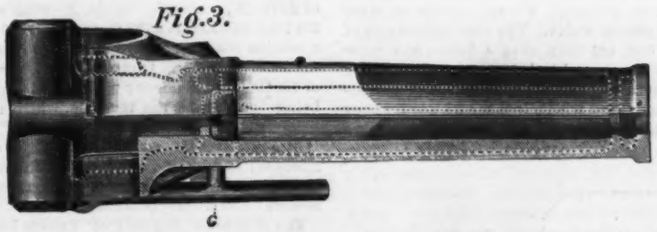
The method of relieving the knuckle from strain is best shown in Fig. 2. A steel spiral spring *L* is encased within a pocket in the drawhead, in the direct path of the closing movement of the rear arm of the knuckle. This spring is designed to act as a buffer, and moreover when the knuckle is in closed position, it absorbs the first shock of subsequent impacts, which is then transmitted back again through the L-shaped knuckle to the draft springs, and finally to the car. Under heavy blows the spring compresses ⅛ in., the rear arm of the knuckle being free to travel that distance before it strikes the solid metal, which prevents further compression of the spring, and saves it from breakage.

Fig.2.



Horizontal Section.

Fig.3.



Back View Showing Uncoupling Lever in Action.

Fig.5.

Fig.4.

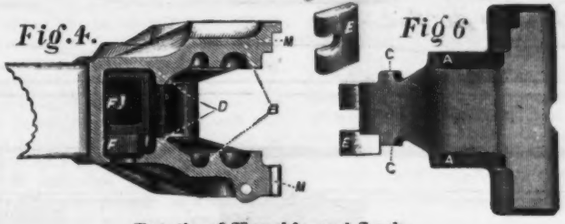


Fig 6

Details of Knuckle and Lock.

THE KEYSTONE CAR COUPLER.

The knuckle is of as strong as possible construction, made to stand a great deal of rough usage without damage, and, taken in connection with the buffer spring mentioned, it is claimed that it can be fractured by nothing short of the most violent collisions. The buffer spring, be it noted, allows the coupler to be fully locked before it acts, so there may be no danger of a rebound preventing a coupling. The spring is therefore a buffer pure and simple, and is not intended to assist at all in the opening of the knuckle.

The method of uncoupling, which is claimed to be a great advantage, is shown more particularly in Fig. 1. It has been designed with the idea that the difficulty heretofore has been that the uncoupling attachment is made an absolute connection between the coupler and car, which an extreme movement of the coupler would bend or break, or else that they were so arranged as to frequently slip out of proper engagement, and catch on shoulders or projections, and would then by a reverse movement be bent or broken, or not act if the coupler moved out of its ordinary position. The Keystone uncoupling device is a simple round rod of iron, *H*, formed with a crank at one end and with a U-shaped bend at the other, and is placed beneath the end sill of the car. Attached directly to the coupler is a lever, *G*, with its rear end extending through the *U* of the uncoupling rod, and having a length greatly exceeding the longitudinal movement of the coupler. This lever has a stem crowned with a flattened head, which enters the bottom of the drawhead and raises the lock, *E*, Fig. 2. When the crank of the uncoupling rod is lifted, the U portion is raised, and in turn raises the unlocking lever. Neither the uncoupling rod nor lever project far enough below the coupler to be injured from below, and the uncoupling rod does not extend beyond the car, to be bent or otherwise damaged. It is claimed that no movement of the coupler can cause any of the parts to become engaged so as to cause them to bend, and that the coupler can be pulled entirely out without in any way injuring the uncoupling attachment.

The difficulty from wear of the contact parts of the M. C. B. coupler has not yet been fully brought out, for the reason that these couplers have as yet been run comparatively little with their own kind. The Keystone Company is of the opinion, however, that time will develop the fact that some expedient must be used to prevent the rapid grinding away and destruction of the traction face of the knuckle; and its remedy for this wear is friction plates of steel, *K*, Fig. 2, fastened to the inner face of knuckle, and so applied that they can be removed and replaced with new ones, whenever worn out. These plates can, of course, be made of harder material than can be used for the knuckle and so should wear a considerable length of time. The manner of fastening them to the knuckle is claimed to be the only practical way of attaching renewal plates to couplers having the small dimensions of the M. C. B. type; and the idea is that by renewing them from time to time, when necessary, the knuckle itself will be rendered practically indestructible. This special feature will not be incorporated with the couplers, however, unless and until it is desired by the railways.

Other novel and valuable features claimed for the Keystone coupler are: The knuckle is attached to the drawhead and rotates upon large solid circular bearings *A* and *B*, Figs. 2, 4, and 6, and on the interior of the drawhead, above and below, are curved flanges *D*, Figs. 2 and 4, which interlock with corresponding curved flanges, *C C*, on the rear arm of the knuckle. These circular bearings and curved flanges all take the direct pull whether the knuckle is in a closed or open position, and because of their much larger wearing surfaces are stronger than a hinge-pin and less liable to lost motion, after long service, and as all the hinge-pin openings are dispensed with, both the drawhead and knuckle should have increased strength.

The lock of the coupler is a large slotted block *E*, Figs. 2 and 5, which works in a vertical slot in the rear arm of the knuckle, and locks it in a closed position by dropping by gravity behind the double shoulders *F F* in the interior of the drawhead. The lock travels with the knuckle arm in its rotary movement, and also locks it in its open position against the pulling out. It is acted upon by the uncoupling lever *C*, which lifts it from behind the locking shoulders, leaving it free to move with the knuckle arm when an uncoupling is being effected.

All of the parts of the coupler, except the spring, are made of malleable iron. Service tests have indicated that a knuckle constructed of this material gives better satisfaction than either steel or wrought iron. The knuckle is, however, made after a patented construction owned by the company, its whole interior being cored, and the walls thus formed having ribs projecting laterally, to brace and strengthen the walls. Knuckles made after this design are said to have given excellent stisfaction, and to be light and cheap to replace if broken. Another feature is, that there are no openings above of any kind to admit either dirt or moisture, all working parts being thus protected.

The ultimate tests for all devices of this nature, subjected as they are to about the hardest service of any parts used in mechanism, must be that of experience, and it would be quite impossible to predict, even if we were disposed to attempt to do so, whether this design will prove in all respects or in any respects the best attainable. That it has ingenious points of merit, well entitling it to thorough practical test, will be evident on the most cursory examination. As to the general question whether the M. C. B. couplers as a class will prove more economical than the link and pin couplers which they displace, we do not think there is the slightest doubt that they will, even by the very inadequate test of direct cost of maintenance. Their great economy will lie in the higher speed and smoother handling of trains which they will permit, which is quite sure to result in longer trains by at least 10 or 12 per cent. on an average as soon as train brakes also are introduced. Besides this, there is of course the question of humanity to employés, which ought to be the dominating and controlling one, but which we fear would not be except that the most careless official can see, that there must likewise be in time a great economy resulting from abandoning the present weak and clumsy system of coupling. We watch with interest every step in this direction, and earnestly hope this and every other coupler which promises any features of utility may have full opportunity to prove them in practice. The coupler illustrated is manufactured by the Keystone Car Coupler Co., of St. Louis, Mo.

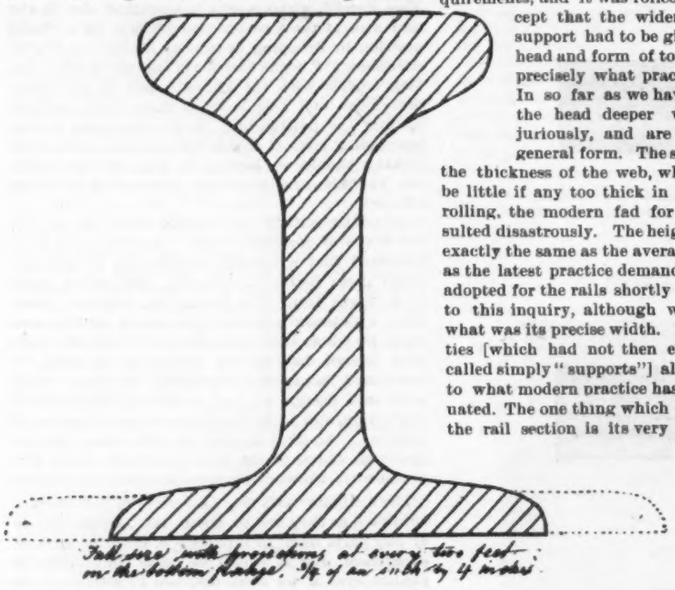
THE TEMPERATURE IN THE COMSTOCK MINES, in Nevada, is found to be as follows by Mr. GEORGE F. BECKER, U. S. Geologist: In the Yellow Jacket mines on the 2,700 ft. level, the air had a temperature of 126° Fahr., and the water 153°. And at the 3,065 ft. level, the water reached the temperature of 170° Fahr.

AT THE IDAHO MINES there are seven "Pelton Wheels" working under an effective head of 523 ft. supplied by a 22-in. pipe, giving about 330 H. P. These wheels receive the impact of the jet in a sort of cup through nozzles about 1 in. diameter and are said to give an efficiency of about 80 per cent.

The First "Vignoles" Rail.

We present to our readers herewith a real curiosity, being a facsimile photographic reproduction of the first drawing ever made of the American type of rail, which our British cousins have been pleased to label the "Vignoles" section, after an eminent English engineer who did not invent it some six or eight years later.

The real inventor of this rail section was Mr. ROBERT L. STEVENS, the President and Chief Engineer of the Camden & Amboy [then Camden & South Amboy] Railroad, and the worthy son of the distinguished Col. JOHN STEVENS, of Hoboken, N. J. Father and son together showed as great an "all-around" mechanical genius,perhaps,as any two men who ever lived, of which this design is but one small item. This is no place to enter into the story of their lives, but no single act illustrates their keen mechanical insight better than the making of this



sketch [supposed to be an autograph of Mr. STEVENS although it is now too late to determine this fact positively] which resulted in the rolling and laying down on the Camden & Amboy Railroad of the first flat-bottomed rails ever laid.

The original drawing is attached to the following manuscript letter, the words included in brackets having been written in another ink and become illegible. Probably several copies of the letter were made, which increases the chance that the one from which our engraving is photographed was only a copy by another hand of Mr. STEVENS' original sketch, but it is far more likely that he made all the copies in his own hand. The letter is as follows:

GENTLEMEN

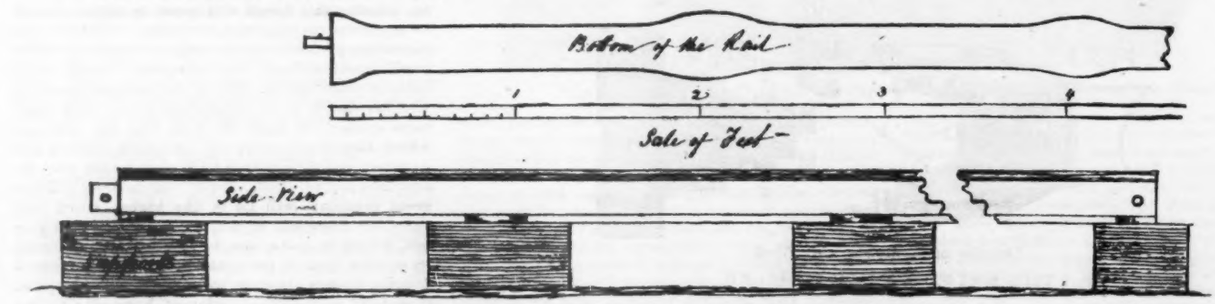
At what rate will you contract to deliver at Liverpool, say from five to six hundred tons of Railway, of the best quality Iron rolled to the above pattern in twelve or sixteen feet lengths, to lap as shown in the drawing, with one hole at each end, and the projections on the lower flange at every two feet. Cash on delivery. How soon could you make the first delivery, and at what rate per month until the whole is complete. Should the terms suit and the work give satisfaction a more extended order is likely to follow, as this is but about one-sixth part of the quantity required. Please to address your answer (as soon as convenient) to the care of Francis B. Ogden, Consul of the United States at Liverpool.

I am your obedient servant, ROBERT L. STEVENS,
President & Engineer of the Camden & South Amboy Railroad & transportation Company.

LIVERPOOL, [month invisible] 1830.

Mr. STEVENS was at that time in Europe after locomotives and other supplies, and in attendance on the great Rainhill or *Rocket* tests, purchasing on the same trip the *John Bull* engine, which still exists and was exhibited at the Philadelphia Exposition of 1876. Thereafter for many years Mr. STEVENS designed all the locomotives for his line and they were built at his own works at Hoboken, nearly all the other contemporaneous American locomotives being built at the then youthful Baldwin works.

This rail section is of a piece with all of Mr. STEVENS' work in his extraordinary prevision of requirements, and it was rolled almost as shown, except that the widening of the base for tie support had to be given up. The width of head and form of top and corner is almost precisely what practice has approved of. In so far as we have deviated by making the head deeper we have deviated injuriously, and are coming back to his general form. The same remark applies to the thickness of the web, which we now know to be little if any too thick in proportion for proper rolling, the modern fad for thin webs having resulted disastrously. The height of the rail is almost exactly the same as the average width of the base, as the latest practice demands, which average was adopted for the rails shortly after rolled in response to this inquiry, although we are unable to state what was its precise width. The spacing and size of ties [which had not then even a name, but were called simply "supports"] also corresponds exactly to what modern practice has approved and perpetuated. The one thing which looks awkward about the rail section is its very flat base, although we



Photographic Reproduction of the Design for the First "Vignoles" Rail.
[Designed and Drawing made by ROBERT L. STEVENS, 1830.]

are by no means clear that this was really ill-advised, or would be now. The shape of the head is a very good compromise between the extreme pear shape and the modern form of square head which has come in with the fishplate.

It is an interesting fact that the rails rolled under this first order literally "wore like iron." They were iron; such as could hardly be had at any price thirty years later. For aught we know, there may be some of them still in use on sidings: there were some a few years ago; and if any still exist they ought to be preserved.

It is not often that it has been given to man to effect by a single drawing such wide spread and long-continuing effects as resulted from the one we here reproduce full size.

THE "TRAM-VIA" is the somewhat peculiar name given to the bustling little steamers that now ply on the Grand Canal of Venice, and stir up the virtuous indignation of Mr. RUSKIN. They are the omnibuses of that quaint, water-logged city, and their patrons chiefly belong to a class that is too poor to hire a gondola at 20 cts. per hour, a sum which often represents for them a full day's wages.

The Design and Construction of Railway Shops.

(*Continued from p 393.*)

TRANSMISSION OF POWER.

In power transmission throughout workshops, small shafts, light pulleys, and high-speed, flat leather belts are common in, and belong properly to, America; but there is a growing tendency to dispense with shafting in favor of rope, and to use hemp or manila rather than wire rope. Examples of the use of wire rope are to be seen at Altoona, St. Paul, and Proctor. The Buffalo, New York & Philadelphia Railway has run its machine shop 312 ft. distant, with ⅛-in. wire moving at a speed of 6,900 ft. per minute, for two years without repair. At Columbus, motion is transmitted by hemp rope moving at 1,500 ft. per minute, and Mr. DRUMMOND at Cowlairs, Scotland, uses rope throughout, even for transmission at right angles.—circumstances under which the Grand Trunk Railway prefers the use of V leather belting. Satisfactory instances of the use of hemp rope between engine and main shaft may be seen in Montreal at the Grand Trunk Railway shops and at the Redpath sugar refinery. A rope 2-in. diameter, moving at 3,000 ft. per minute will transmit 25 H. P., that is, a daily equivalent to a 4-in. belt moving at the same speed. Three-ply manila rope is better than four-ply. The pulleys should be at least 30 times the diameter of the rope, and the shafts not less than 20 ft. apart, the angle of the groove in pulley rim 40°, the rope not being allowed to bottom in groove as in the case of wire rope. Some actual tensions are as follows: a manila rope 6½-in. in circumference, with a speed of 2,972 ft., transmits 23 H. P. with a tension of 256 lbs.; another at 3,782 ft. transmits 40 H. P. with a tension 349 lbs.; a third has seven ropes of 1½-in. diameter, at 2,355 ft. transmits 34 H. P., with tension of 476 lbs., the tendency with increasing experience being to increase the tensions, which are still far below those used with iron and steel wire ropes. Hemp apparently suffers little from climatic influences; and its life, especially at the weak point—the splice—may be lengthened by coating it with beeswax and a little plumbago.

The Southern Railway of France has probably made the most complete application of hemp rope in the minute division and transfer of power. The through shaft in the shop is provided with numerous V pulleys, by which motion is given to three-quarter inch diameter hemp rope, so that at every point the power may be delivered to light overhead cranes as well as to numerous specially designed portable machine tools. For instance, in the boiler repair shop, not only are the drills so worked at any angle or in any corner, but the holes are tapped, and the screwed stays put in, much in the same way as similar work is done to a limited extent with the Stow flexible shaft.

Electric transmission has been used in Germany for some years under restricted conditions. It has some advantages, as the conductor is less clumsy than shafting, steam-pipe, or rope, its position can easily be changed, and the motor is compact and less of a nuisance than a small steam engine. Loss of power there certainly is, but not much in the actual transmission between points far apart, if wire of reasonable diameter is used, and the less the power being taken off, the less is the percentage of loss in the transmitter, the opposite rule holding good with shafting. The chief loss is in the use of

double machinery, the first to convert motion into current, and the second to convert current into motion. Every month is simplifying the problem and minimizing the waste; and the ready adaptability of electro-magnetic machine tools (without intermediate machinery) to the varied purpose of drilling, tapping, rivetting, chipping, and caulking thick steel ship plates in position, their high duty and rapidity of work, are shown in the paper by Mr. F. J. ROWAN, recently discussed by the Institution of Mechanical Engineers (Proc. Aug. 1887), in concluding which he expresses his belief "that it will be found both economical and otherwise convenient to adopt electrical distribution in engineering workshops, instead of the existing system of shafting and belts, or even hydraulic distribution of power."

Transmission of power by steam-pipe and independent engine for each shop has not, up to date, been common in countries liable to low temperature. In mild climates, the use of separate wall engines with the cranks coupled direct to shop shafting is most satisfactory, and a pair of locomotive cylinders are often used for such service, as the engines occupy little if any floor space when set vertically, and each shop can be run independently when it is necessary to work overtime.

With the use of modern asbestos and silicate coverings, there is but little loss by condensation in the long steam-pipe. Mr. W. T. BIRD, in his careful experiments (see North of England Inst. of Mining Engrs. Proc. 1882-3) has shown that the condensation in an exposed pipe 1,000 ft. long is sufficient to reduce the steam to 76 per cent. of its boiler efficiency, while coating the same pipe with silicate cotton raises the efficiency to 95 per cent.

MACHINE GROUPING.

At one time the aim in arranging a machine shop was to group the large machines close together, so that the heavy and bulky material steadily progressed from one to the other without retracing its path. With the adoption of light overhead cranes and single rail tramways for moving heavy weights, the rehandling of raw material has lost much of its importance and most of its expense, so that the favorite arrangement is to mass similar machines of all sizes close together, permitting one skilled man to be put in charge of the whole class. An alternative—when a charge-man is not employed—is to put one skilled attendant to each pair of such machines. However, the main advantage is that the whole floor space can be more fully utilized when machines of a class are massed than when different machines of about equal size and capacity are grouped together.

When small machinery is placed on a narrow side gallery, it is better, if window light will permit it, to locate a double row of machines, back to back, in the center of the gallery, thus leaving a narrow passage on each side, rather than to put them in two lines with the passage between them. This grouping enables each attendant more easily to keep his raw and finished material separate from that of his neighbors, and there is less countershafting needed. Its one defect is that it brings the attendants—usually boys—close together and face to face. Mr. W. WILSON has this arrangement of lathes on the ground floor at Alton.

The solidity of machines designed for railway shop service permits tools with single cutters to take wide and deep cuts, and in milling machines allows of a much higher speed at cutting surface (by virtue of which they are rapidly displacing shapers, planers, and slotters). The actual depth of cut has little influence on the cutting speed; hence, it has been found at the forge not economical to smith too close to size. This refers, of course, only to hand work. All wrought-iron stamped or worked out under "formers" should, for several reasons, be made close to size.

FOUNDRY.

Foundries for the production of iron castings rarely form part of American railway equipment, yet no shops return a larger interest on the capital invested, are more useful in the rapid despatch of daily work, or more helpful in case of emergency. That these benefits may be realized, their design and details should not be fortuitous, even if many of them now in daily service suggest the inference that, like TOPSY, they "growed."

Many years' service—as well as recently created shops—shows that a most convenient plan is to divide the surface to be roofed over into two sections of about equal length and span, placing them at right angles to each other, with the cupolas in the inner corner as the most central position without occupying floor room, the square of open land behind the cupolas being utilized for storage of scrap iron, fuel, etc. The foundry at Point St. Charles is practically based on such a ground plan, although an existing building was utilized for the purpose. (See Paper by Mr. F. L. WANKLYN (Member) in Pro. Inst. C. E., vol. 88, part 2.)

Overhead travelling cranes are preferable, so that the molten metal will not need transfer from one crane to another; but if jib-cranes must be used, one set in front of and between the two cupolas will swing into both sections through an arc of fully 270°. The sand stores, core ovens, etc., being set close to inner wall, light is received through windows in the long outer walls.

What may be considered a model foundry has recently been completed at the Pittsburg Locomotive Works. Mr. D. A. WIGHTMAN, the Superintendent, says: "One of its peculiarities is the location of the core oven and core room, which are placed below the level of foundry floor, the top of the core ovens being on a line with said floor, and the runaways—used by trucks out of the ovens—are covered, all except a hatchway left open for dropping the heavy dry sand cores and mould, down with a crane.

"The core room is on the same level with the core oven floors; but is left open at the top of the foundry roof, and receives its light from the main windows of the building. Communication between the core room and the south side of the core ovens is had by means of a passage way under railway track. The sand pits all open out of the core rooms and have manholes outside for shoveling the sand through from wagons and cars.

"This arrangement of core ovens was suggested in trying to obtain suitable light, as one side at least of nearly all foundries have their light shut out by core rooms, core ovens, and cupola house. The plan adopted obviates this difficulty, and you will probably conclude after examining the drawings that this building has better light from the ground than any foundry you have ever seen.

"The sand conveyor indicated on plan is simply a Gandy Belt, placed beneath the surface of the foundry floor, upon which the sand is thrown, from any point where it may be lying, and conveyed to an elevator which delivers it into a revolving screen, thence falling into the hoppers over the moulding machines, which are kept fairly full, so that upon opening them at bottom, the flasks are filled very quickly. The conveyor saves the labor of wheeling the sand up to and shoveling it into the moulding machines. One man takes care of all the sand for the two machines, whose output in castings varies from 5,000 to 12,000 lbs. per day."

BRASS FOUNDRY.

An effective, well-ventilated, and therefore healthy brass foundry is a square, single-storied, semi-detached building, with the windows, moulder troughs, and core benches on the three open sides. A circular chimney is in the center, having around it a ring of crucible furnaces below ground level. This arrangement requires separate core ovens on the face of blank wall, an expense justified where the output is large. In smaller foundries, the furnaces are in line in front of a blank wall, the flues between furnace and chimney passing around the core ovens, the chimney being supported on iron girders, six or seven feet above floor level, so that any portion of the furnaces, ovens, or flues may be renewed without disturbing or weakening the chimney.

SMITH'S SHOP.

The smithy used to be a narrow shop, with the fires ranged close to the side walls and an open central passage. This arrangement has been modified, as the large machinery which is displacing hand work is most conveniently set in line down the center, with a passage on each side of it—that is, a track between the machinery and each line of fires; hence smithies have increased in width from 40 to more than 60 ft. Certainly the smith does not need much window light, yet he should not be made to stand between his work and the window when at the anvil, as is done when the fires are set at right angles to the sidewalls. The better plan, which has long prevailed at Sir WM. ARMSTRONG'S works and elsewhere, is to group them in pairs set parallel to the wall.

A recent experimental attempt to draw off the forge smoke through underground flues by the natural draft of a 140-ft. brick chimney was not successful (whatever may be the result with higher and costlier chimneys). The most complete method of doing this, as at the Valley Falls shops on the Pittsburg & Western Railway, is to connect the smoke-stack of each fire with a central smoke-flue running parallel to and under the ridge of the roof, providing it at the outlet with a suction fan blowing into a short chimney, whose draft it improves. Brick hoods and smoke-stacks make a permanent arrangement when each fire or group of fires has a separate outlet; but if the building is to be kept fairly clear of smoke, movable sheet plate hoods are needed.

For ventilation, small flues from outside, passing through dwarf brick pilasters about 2 ft. above floor level, with horizontal gratings opposite and under the control of each man, are effective for the admission of air; the smoke-stacks or movable louvre boards in clerestory on roof being depended upon for exit, though neither are satisfactory at low temperatures unless the smoke flues have induced draft.

Pressure blast for fires should be distributed in overhead galvanized pipes, with a branch down to each set of hearths, and provided with hinged collapsing valves that freely fall open inwards when there is no pressure in the pipe. This simple device prevents any inflammable gas from accumulating in the mains after the fan is stopped, thus avoiding explosions when lighting up.

The number and variety of steam hammers is increasing, and as the interest on the first cost and the foundation for the handier sizes does not amount to the wages of a striker, and as there is no comparison between the relative usefulness and productive value of the two, each new smithy is likely to have a larger number. The points in the setting of steam hammers worthy of note are: that the foundation for standard and for anvil must be kept quite distinct; that solidly bolted timber on end makes one of the best supports for the anvil block; and that, as no foundation fully absorbs the throb of a large hammer, the forge and smithy should be removed as far as possible from the shops holding tools of precision, but not beyond reach by a standard gauge track siding, with some yard-room reserved near at hand in which to store the scrap, fuel, and the steel dies, or "formers," that accumulate around a much-used hammer.

BOILER SHOP.

The boiler shop in all satisfactory works is detached, so that the noise of hand riveting (not yet completely dispensed with) may be as little of a nuisance as possible. In height and width it is often a duplicate of the erecting shop, but with flush floor. It is worthy of note that some works on this continent, not using overhead traveling cranes in the erecting shop, appreciate their usefulness so far as to equip the boiler shop with them.

The hydraulic and other heavy machinery for handling thick plates is massed at one end, and the lighter equipment for thin plates and tender tanks at the other end of one side of the shop, the floor on the other side being left open for actual construction or repair. The plate furnace (with forced draft) is set so that its flue may have a short run to the chimney erected for the forge or smithy, and close to the heavy flanging tools.

Standard gauge as well as trolly tracks cover the floor, and the plate store (or rack) is close to main the track and to the furnace.

Accommodation should be ample, for the boiler shop, as most managers find, is one of the least flexible; and therefore it is wise to give it space and a full equipment of modern tools.

FLOORS.

European practice in flooring varies from wood block on solid foundation to plain block and plank, using clinker, hard-packed cinder, or clay in the smithy, and concrete or asphalt for paint shop. The German Railway Union recommend stone or tile, except where men stand at machines, and here wood should be used. Slate gives, all things considered, the best service and wear under foot, of

any known substance, and being light, strong, and durable can be strongly recommended for stairs and steps. The continuous concrete floor used at Columbus has for its first course, 6 ins. of broken stone, for its second, 8 ins. of finely broken stone mixed with cement, and for the finishing course, a compound of Portland cement, asphalt, and sand, 4 ins. deep, which, being slightly elastic, is not readily cracked by a sudden blow.

South and west of Pennsylvania a solid floor is made by rolling the earth, and then bedding, about 30 ins. apart, half-round locust stringers in 4 ins. of concrete, before it sets hard. The stringers are floored with 2-in. Georgian pine plank coated with hot tar. Oak flooring is often used in that neighborhood, not because it lasts any longer than white pine, but because it is cheaper in the local market. The Georgia Central Railway coats the sills with rosin, packs the earth up to within half an inch of their top, spiking the planking down after boring holes through it. Rosin is then run in through these holes until the whole cavity is full, thus completely isolating the timber from the damp earth. In Canada a cheap floor for light weights is made by bedding half-round cedar in a foot of engine cinders, and nailing 2-in. pine plank on top.

SELLERS, of Philadelphia, uses under his machine tools a continuous iron resting on brick foundation walls, and between the machines pine plank for the workmen to stand upon.

TURNTABLES.

The American pattern of turntable is a "top deck" structure of cast iron up to the common diameter of 60 ft. The weight of table and load is carried on a single fixed central pyramid, with one of the many forms of anti-friction caps on the top, to lessen the resistance to movement. No gearing is used to give the table motion. A short lever or hand-spike stands out from one end, and two men are usually sufficient to walk the table and its load around.

A fixed circular rail in the pit and end wheel trolleys at the outer ends of the girders is provided; but they come into use and carry weight only when the load is being moved on or off; at other times the table is in balance, and the trolly wheels ride just clear of the ring-rail.

When the turntable girders are of cast iron, it is advisable to dispense with any lock or catch to hold the table in line with the radiating tracks, on account of the danger to the castings if the bolt is shot out suddenly while the table is in motion, and because the engine-men will move an engine on to the table more carefully when it is held in position by hand than when it is locked.

With wrought-iron tables these precautions are not so necessary, as they are not liable to failure by sudden side jar, but almost all wrought-iron tables designed or built by dealers to their own specifications ultimately prove to be lacking in stiffness. For locomotive service, wrought-iron turntables of 75 ft. diameter have been used at Roanoke, Virginia, with the object of getting rid of frogs in the radiating tracks (which tracks were of mixed gauge).

Turntables of 100 ft. diameter are invariably of wrought iron with deep side girders, the load being carried on the bottom deck, and the weight supported and moved upon small tapered rollers massed in a ring of 10 or 12 ft. diameter, the whole being similar in design to the ordinary form of "draw span" in American swing bridges, and therefore not lacking in stiffness. Part of the weight must be carried on the outer ring rail, so as to restrict within narrow bounds any tendency to balancing on the central ring support.

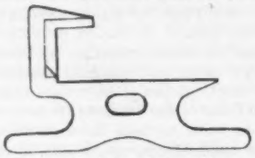
The motive power is usually an independent boiler and engine, running on the ring rail, and coupled to one end of the table by drag links or other special form of adjusting connection, so that the oscillations of the table under unequal loading shall not interfere with the adhesion of the engine on its single rail.

In running sand about three years ago, the author put in a central foundation for a 50-ft. table, by making a timber hollow box frame of pyramid shape, 10 ft. square at base, 5 ft. square at top, and 4 ft. 6 in. deep, weighting it with rails to sink it as hand labor excavated the material from the center. When the top was sunk flush with the level of pit, the anchor bolts, passing through two 12-in. baulks, were put in place, and the whole filled in with quick-setting concrete. A sand pump was kept going the whole time until the frame was filled, and the mass was finished flush, to receive the base of the center casting, no capstone being used.

(TO BE CONTINUED.)

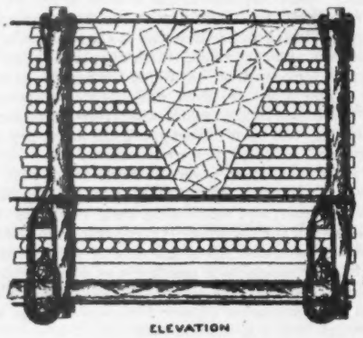
Memphis Harbor Improvements.

In our article of last week on the Government Protection Works on the Mississippi River, at Memphis and elsewhere, the following cuts came too late



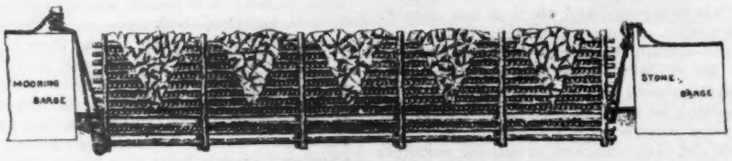
Hook Cavil for Connections.

for insertion in their proper places. These views show the plan of spur-dike revetment as designed



Spur-Dike Revetment, Showing Ties.

and constructed by Capt. SMITH S. LEACH, U. S. Engineers, for the work carried out by this officer at Memphis Harbor. The plans and sections explain the method of building, connecting, and loading the mattresses, and also a special hook cavil used in this connection.



Memphis Harbor Spur-Dyke Revetment.

THE CHICAGO SMOKE NUISANCE is being discussed by the *Tribune* of that city as an important factor in the selection of the Queen City as the site for the World's Exhibition of 1892. It is suggested that the introduction of natural or fuel gas would help to end the trouble. But this improved fuel is not there yet, and in the meantime the *Tribune* acknowledges that Chicago "is intolerably and abominably filthy" and utterly unfit as a place for the Fair of 1892. We agree with our contemporary; visitors to such an exhibit prefer sunshine to a smoky atmosphere and a downpour of soot.

Garbage Disposal.

At the recent meeting of the Public Health Association, in Brooklyn, N. Y., Dr. R. MARTIN, Health Commissioner of Milwaukee, Wis., and others interested read papers on the disposal of garbage, of which the following is an abstract:

The present system in Milwaukee is the Mertz system, which, from June 11 last, has given the best satisfaction. The plant is owned by a company of capitalists. The quantity of garbage collected is over forty tons daily, which, with that brought to the works by the commission dealers, wholesale men, and grocers, brings the total up to fifty tons, which is promptly disposed of. The works are located in the slaughter-house district and the building is a two-story frame, 62 x 110 ft. The garbage teams drive up an inclined roadway to the second story, where the garbage is thrown on the floor to be scraped into the dryers, of which there are eight. The time occupied in drying the garbage varies, of course, with the quality and amount of moisture, but is usually from eight to eleven hours.

Dr. S. S. KILVINGTON, Commissioner of Health, Minnneapolis, Minn., read a paper on "Statistics on River Pollution, with Observations Relating to the Destruction of Garbage and Refuse Matter." Dr. KILVINGTON said that in the majority of cities the problem of the disposal of garbage is practically unsolved. A circular letter was sent to the health officers of 175 cities in the United States, and replies were returned by only 66. Less than one-third of these showed the possession of any statistics regarding the quantity of waste materials disposed of per annum. A surprising indifference to the subject is shown in many directions. Health officials in cities of 100,000 inhabitants "have not thought about it," or "have no opinion on the subject," or "have had no experience and entertain no views." In the Mississippi River during the past year, eight cities alone deposited 152,675 tons of garbage and offal, 108,250 tons of night soil and 3,765 dead animals. In the Ohio River, five cities in the same period dumped 46,700 tons of garbage, 21,157 tons of night soil and 5,100 dead animals. In the Missouri River four cities cast 36,000 tons of garbage, 22,400 tons of night soil and 31,600 dead animals.

EDWARD CLARK, Health Officer, of Buffalo, N. Y., condemned the dumping of garbage into rivers and lakes; also the practice of dumping it into low places for filling purposes. He had examined different cremating furnaces, but could not bring himself to believe that the destruction of garbage by burning was a perfectly sanitary process. Buffalo was the first city to adopt the improved plan known as the extractive method, as exemplified in the Mertz system. He believed that this system was by all odds the most perfect from a sanitary standpoint. It does not destroy the garbage, but converts it into products that have value, in a manner entirely within the boundary of strict sanitary requirement, and by a process which destroys and removes all of the deleterious organic matter, disease germs, etc. Dr. MCDONALD, of Missouri, asked if night soil could also be treated. Dr. CLARK said that in Buffalo that was sold to the farmers after treatment. Dr. G. P. CONN, of New Haven, thought that by far the worse part of the refuse usually went through the sewers into the rivers. City Chemist VANDERBERG, of Buffalo, spoke briefly, and Mr. HENRY E. FLEISCHMANN, of New York, spoke enthusiastically in favor of the Mertz system, in which he is a stockholder. Dr. KILVINGTON called on the delegate from Chicago to detail his experience with the garbage cremator. Inspector YOUNG, of Chicago, spoke briefly on the complaints occasioned by the carrying of the garbage. Dr. GIBON, of the Marine Hospital, offered a motion, which was adopted, that the present committee on garbage (numbering eight) be increased by the addition of one, and directed to report at the next convention of the Association the result of their deliberations.

Constitutional Provisions Relating to Irrigation in Wyoming and Montana.

We give below the provisions adopted by the Territorial Convention of Wyoming, and those embodied in the Constitution of the new State of Montana, regarding irrigation.

In both Wyoming and Montana the people realize the advantage and necessity of regarding water as public property, subject to appropriation without relation to the land through which it may flow. Wyoming has done herself credit by providing for public supervision of the appropriation and subsequent distribution of water, und also by establishing the term of the State Engineer's office as six years.

Doubtless subsequent legislation will amplify these provisions, supplying the details necessary for successful and practical operation. It is to be hoped that both Montana and Wyoming will issue yearly reports setting forth the progress and status of irrigation within their boundaries. Also that Montana will provide (if it has not already done so) for a State Engineer and Superintendent of irrigation. The Wyoming provisions are:

The water of all natural streams, lakes, or other collection of still water, not heretofore appropriated, is hereby declared to be the property of the State, subject, however, to appropriation for beneficial uses.

There shall be constituted a Board of Control, to be composed of the State engineer and the superintendents of the water divisions; which shall, under such regulations as may be prescribed by law, have the supervision of the waters of the State and of their appropriation, distribution and diversion and of the various officers connected therewith. Its decisions to be subject to review by the courts of the State.

Priority of appropriation shall give the better right. No appropriation shall be denied except when demanded by the public interests.

The Legislature shall by law divide the State into four water divisions and provide for the appointment of Superintendents thereof.

There shall be a State engineer who shall be appointed by the governor of the State and confirmed by the Senate; he shall hold his office for a term of six years or until his successor shall have been appointed and shall have qualified. He shall be president of the Board of Control and shall have general supervision of the waters of the State and of the officers connected with its distribution. No person shall be appointed to this position who has not such theoretical knowledge and such practical experience and skill as shall fit him for the position.

The Montana constitution provides that: The use of all water now appropriated, or that may hereafter be appropriated, for sale, rental, distribution or other beneficial use, and the right of way over the lands of others for all ditches, flumes, canals and aqueducts necessarily used in connection therewith as well as the sites for reservoirs necessary for collecting and storing the same, shall be held to be a public use.

Conover's Belt Power Air Pump and Condenser.

The air pump and condenser illustrated herewith is one recently designed by Messrs. Conover & Co., 219 Market St., Newark, N. J., to fill demands from power users who are seeking the greatest attainable economy of steam in their steam engines. Its effect is to turn a high-pressure engine into a low-pressure, without introducing complications in the engine itself, or requiring a new one.

With the introduction of high-speed compound engines, there is felt the need of a thoroughly efficient and simple condensing apparatus. The power required to drive it should be reduced to a minimum, and this power should be obtained economically, otherwise the advantages gained by condensing will be seriously affected, if not wholly counteracted. In fact, it is a matter of record that certain engines have shown better economy running non-condensing, than when condensing, owing to the wasteful manner in which the power was applied to the condensing apparatus.

The air pump and condenser illustrated is claimed to have proved in practice to be an efficient, simple, and durable arrangement. As will be seen by the engraving, the pump is run by a belt, which can be direct from the engine shaft or from a countershaft, whichever may be the more convenient. An examination of the engraving will make the operation of condenser and air pump quite plain. The exhaust steam enters by the large pipe at the right. The spray distributes the injection water in such a manner that every particle of steam, so far as possible, may come in contact with the water, and thus effect condensation with a minimum amount of water. The opening from the condenser to air pump is shaped to allow free passage of the water, and the pump is made amply large to remove the greatest quantity of water needed for condensing to the full capacity of condenser proper. The reciprocating parts are counterbalanced by means of a weight in the wheel to insure smooth running. As will be seen, the air pump is vertical and single acting, which the builders believe to be the best form to avoid air locks; and the design throughout has been prepared with a view to the avoidance of all corners or pockets where air can collect and remain.

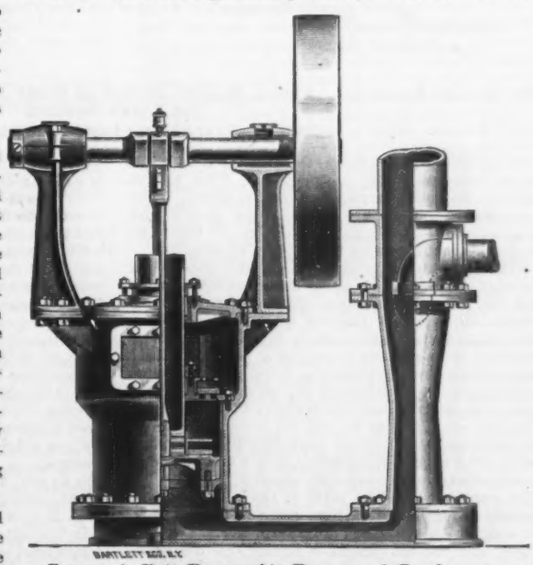
This condenser seems specially adapted to the requirements of high-speed compound engines, and electric light and power plants, because it can be run at a speed independent of that of the engine or it may be attached to more than one engine. It is also adapted to be applied to existing plants to effect either a saving of fuel or an increase of power with same fuel. All wearing parts and valve seats that come in contact with injection water are made of best composition metal, and when the air pump is in operation, the valves and stuffing box are constantly covered with water, effectually sealing them. All parts are easily accessible, likewise, without dismounting wheel or shaft.

As a whole, the design seems well adapted to the use intended, and we are informed that practical tests of it have shown a very satisfactory economy, although we are not yet able to present any records of tests showing just what it will do. This we shall hope to do later.

Four different sizes of the condenser are now manufactured, as follows:

11	in.	x 5-in.	stroke	adapted to 50 to 100 H. P.
13½	"	6 "	"	" 100 to 200 "
17	"	7 "	"	" 200 to 350 "
21	"	8 "	"	" 350 to 500 "

We can see no reason why a condenser of this kind should not prove highly economical in many cases, especially when fuel is dear and the demand for power great.



Conover's Belt Power Air Pump and Condenser.

Elements of Weather in the United States of most Interest to Engineers, for the month of September, 1889.

STATIONS.	Temperature. Degrees Fah.				Wind velocity. Miles per hour.			Precipitation. Rain and melted snow. Inches.		
	Average	Max.	Min.	Range.	Average.	Max.	Direction at time of Max. Vel.	Total.	Heaviest in 24 hours.	No. rainy days
Northern Cities.										
Northfield, Vt.	57.4	83	30	53	6.3	36	N	4.06	.94	16
Portland, Me.	59.7	76	40	36	7.3	31	SW	2.49	1.57	6
New York City	65.8	85	46	39	11.8	41	N	7.43	2.46	15
Pittsburg, Pa.	65.6	90	44	46	5.1	24	NW	2.87	1.40	11
Chicago, Ill.	62.7	84	35	49	7.8	28	NW	2.75	2.08	7
Omaha, Neb.	63.6	88	38	50	7.5	33	SE	1.74	.82	7
St. Paul, Minn.	59.2	70	48	22	8.5	36	W	0.51	.21	10
Duluth, Minn.	54.8	76	36	40	7.7	29	W	4.02	2.94	14
Bismarck, Dak.	55.8	93	26	67	10.4	46	N & W	0.48	.16	6
Average.	60.5	82.8	38.1	44.7	8.0	33.8		2.93	1.40	10.2
Southern Cities.										
Washington City.	66.0	86	42	44	7.0	28	N	3.88	1.55	15
Louisville, Ky.	67.0	90	42	48	4.4	29	E	4.38	.83	11
St. Louis, Mo.	67.0	90	42	48	9.3	36	W	3.54	1.85	10
Savannah, Ga.	75.1	91	55	36	4.4	26	SE	4.68	2.15	8
Leavenworth, Kan.	64.7	91	35	56	5.2	24	NW	5.73	2.06	15
Jacksonville, Fla.	78.1	95	57	38	4.5	32	S	8.49	4.30	10
Chattanooga, Tenn.	69.1	89	40	49	4.5	36	NE	7.87	2.87	14
New Orleans, La.	78.6	94	58	36	6.9	30	SW	6.40	2.05	11
Memphis, Tenn.	71.8	92	51	41	4.7	24	S & W	3.01	1.80	9
Palestine, Tex.	71.9	90	53	37	3.8	18	NW	4.73	1.24	14
Average.	70.9	90.8	47.5	43.5	5.5	27.3		5.27	2.08	11.7
Western Cities.										
Helena, Mont.	55.0	80	28	52	7.0	30	SW	0.48	.24	3
Port Angeles, Wash.	51.3	72	32	40	3.7	24	W	2.35	1.10	6
San Francisco, Cal.	64.6	89	51	38	8.1	27	SW	*T	*T	0
Salt Lake City, Utah.	60.6	84	35	49	5.0	24	NW	0.52	.26	3
Denver, Col.	60.0	94	30	64	6.4	36	NW	0.28	.15	6
Yuma, Ariz.	83.4	106	58	48	6.6	30	N	0.00	0.00	0
Santa Fé, N. Mex.	60.9	83	30	53	7.1	46	N	0.67	.32	7
Average.	62.3	86.9	37.7	49.2	6.3	31.0		0.61	0.30	3.6

*T indicates trace of precipitation.

A UNIFORM SYSTEM IN RECORDING RESULTS OF WATER ANALYSIS has received the attention of both the American and the British Association of Science. The latter body, at its last meeting, by a committee report practically agrees with the suggestions of the American Association. The British committee recommends the decimal system, milligrammes or grammes per litre; all results to be expressed in parts per 100,000. For potable water, the report to state total solid matter in suspension and solution; organic carbon and nitrogen; oxygen consumed as indicated by permanganate; ammonia expelled by sodium carbonate and by alkaline permanganate; nitrogen as nitrate and nitrites; hardness, temporary, permanent, total. In mineral waters: carbonate of lime, of magnesia, of soda; total *Ca, Mg, K, Na, Fe* (ferrous), *Fe,* (ferric); acid radicals SO_4, NO_2, NO_3, PO_3, SiO_3, *Cl, Br, T, S.* In dissolved gases, cubic centimetres per 1 litre: CO_2, *O, N,* H_2S.

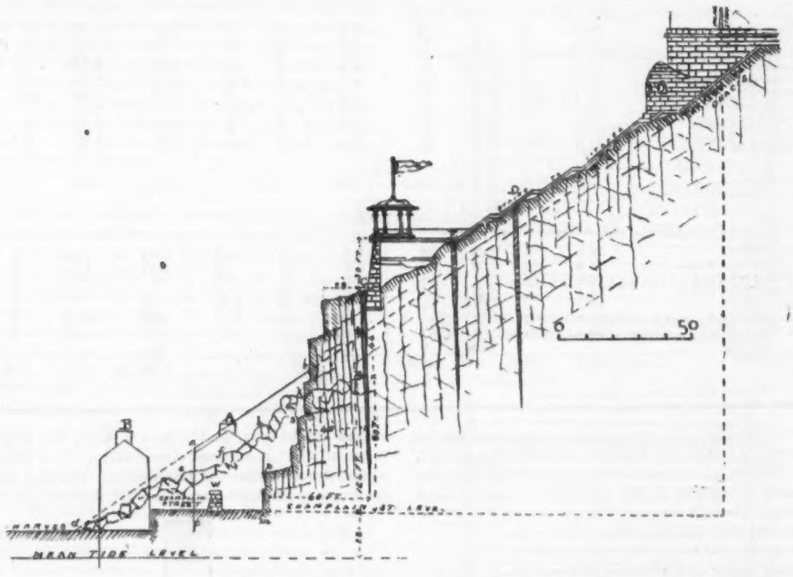
A MARSEILLES-BUENOS-AYRES CABLE CO. is said to have been formed in Paris, with a capital of $10,000,000, guaranteed by the Argentine Government.

The Quebec Land-Slide.

Mr. CHAS. BAILLAIRGÉ, City Engineer of Quebec, contributes to the *Canadian Architect and Builder* the section reproduced herewith, which is to an unexaggerated vertical scale, showing the cause and effect of the late disaster. He says in his accompanying letter:

The whole Quebec promontory or rock, on which the citadel and city are built, is not, like the Laurentian hills and mountains in the near vicinity, a compact mass of gneiss or so-called granite, but formed of a series of parallel strata of a schistous and lamellar structure, geologically called, I believe, "Utica Slate."

These strata, of a sedimentary nature, and therefore originally more or less horizontal, have, by some cataclysm of bygone days, been tilted up in a way to become nearly vertical; the strata towards the north side of the cliff inclining over or dipping inland, while towards the south and east they incline or dip towards the St. Lawrence.



The Quebec Landslide. Sketch Section of Cliff at South End of Dufferin Terrace opposite the King's Bastion.

[Showing at *d e f h k n* the Landslide of Sept. 18, 1889.]

The rocks composing these strata are far from being, all of them, solid and homogeneous. They are of different thickness, varying from feet to inches. They are fissured and cracked in directions more or less perpendicular or inclined to the lay of the beds, though generally parallel to the plane of cleavage.

Water has entered for centuries at the crop out of everal of the beds, which under the influence thereofs, and that of frost and other climateric causes, have become disintegrated, reduced to rotten shale of a very thin lamellar texture, which can be extracted by the hand, bordering, so to say, on a return to their original clay, thus dividing the more solid beds and bringing about a separation of the strata as indicated at the several crevasses hereinafter alluded to. In word, the whole face of the cliff, for some hundreds of feet north and south of the land-slide and for many feet in depth towards the interior, is of a loose and demoralized texture, and hence the danger.

The summit or highest point of the land-slide immediately underlies the salient angle of the fortification wall at the south end of Dufferin Terrace, which is built over the old carronade battery still to be seen beneath the terrace flooring at this point.

The terrace floor or promenade is 182 ft. above mean tide level of the St. Lawrence. The wall supporting the terrace at its south extremity is some 30 ft. in height. Champlain St. is some 28 ft. above mean tide level at the site of the accident, and the cliff, therefore, at this point, about 124 ft. high above Champlain St.; the section or stratum of rock, a portion of which has given away, being 60 ft. wide at base, 28 ft. at summit, and say of an average thickness of 40 ft.

The accompanying sketch is a section of the cliff at about the centre of the land-slide and at its highest point; the cliff, as it was before the occurrence, being shaded by hatchings along its outer edge or outcrop, while the surface of the fallen rock is roughly shown at *d e c h k n*; the portion which gave way being that between *k* and *n*, along the line of fissure or crevasse *C N*, where the height from *C* to *N* is about 44 ft., while the length or extent of the fallen portion may be about 300 ft.

In January, 1880, at the request of Sir H. LANGEVIN Minister of Public Works of the Dominion, I reported as to the dangerous features of the rock, and recommended that, either buttresses, *a c m p q s k b* or erected at intervals of some 20 to 30 ft., some ft. high at *a*, 80 ft. at *b*, to prevent the rock from falling, which should it do, I said, would destroy the houses on both sides of Champlain St., and sacrifice the lives of all the inmates; or that the houses be purchased and demolished, thus in either case saving the lives of the tenants or occupants.

This second or alternative scheme was decided on, but only partly carried out, by purchasing and demolishing the houses at *A* on the rock side of the street while those at *B* on the opposite side were allowed to remain; and these it is, numbering in all about a dozen or less, of which some 7 have been destroyed and 45 of the inmates swept out of existence by the late catastrophe.

Other fissures, as at *E*, are to be seen inland or westward of the crevasse *C*, whence the rock fell, and there is a more alarming one at *D*, which, from not quite 3 ft. which it was before the accident, increased its dimensions at the moment of the slide by some 7 or 8 ins. and is therefore now more than 3 ft. in width.

What I propose, to counteract the overthrow of that portion of the cliff between *C* and *D*, some 80 ft. or more in width, is, that the upper portion of the rock from *C* towards *D* and down to *t*, be cut away in large masses of a cubic yard or more, and allowed to fall on top of the present *débris*, and trimmed off to the line of slope *d t*, which is 1¼ base to 1 vertical, thus imitating the levelling hand of time; and by thus staying the base of the cliff to prevent the fall of the section of rock between the crevasses *C* and *D*, which portion is now more secure at this point of the cliff on account of the abutting *débris* from *d* to *n* than it was before the slide occurred.

To do this, a portion of the south end of the terrace must be sacrificed, the kiosk being removed to a point above *D*, to which the promenade may still extend by an incline or by a flight of easy treads from the present terrace level opposite the end of Des Carrieres St. Or the terrace, if the additional expenditure of some $20,000 to $30,000 for the purpose be warranted and can be afforded, may be kept intact by procuring elsewhere the required material—some 10,000 to 15,000 cu. yds. more or less—and dumping it down from above on the present *débris*; or, as proposed by Mr. LIGHT, M. Inst. C. E., though of course at still greater cost, by building a continuous buttress of solid cement masonry, of such a breadth of base and such a height as to prevent all future alarm and danger.

It will be a subject for general regret if any part of the Dufferin Terrace, the view from which is one of the loveliest and grandest in the world, shall be sacrificed, if it is possible to prevent it. That historic hillside, about which cluster so many memories of the past, and which by the enlightened efforts of Lord DUFFERIN was converted into what is reasonably claimed to be the finest city promenade in the world, ought not to be mutilated and defaced to save any such sum as $20,000 to $30,000, nor twice that sum. Plainly something must be done, and at once, but it greatly concerns the honor of Canada not to permit defacement of this spot in the interest of safety, when safety can be equally well attained by the expenditure of a moderate sum of money in suitable retaining walls.

PERSONAL.

Mr. ELIJAH B. PHILLIPS, President of the Fitchburg R. R. Co., has resigned.

Mr. ALEXANDER DUNCAN, formerly of Providence, R. I., and one of the early presidents of the Providence & Worcester, R. R. died recently in London, England.

Mr. J. C. MORDAUGH is to be Superintendent of the Colima Railroad, now being constructed from Manzanillo through Colima toward Guadalajara, Mexico.

Capt. EUGENE GRIFFIN, U. S. Engineer, has resigned his position as assistant to the Engineer Commissioner at Washington, D. C.

Mr. FLYNN C. DAVIS is the new Assistant Superintendent of the Kentucky & Indiana Bridge & Railroad Co. at Louisville, Ky.

Mr. W. H. NEWMAN has been appointed second Vice-President of the Chicago & Northwestern road. He will have charge of the traffic of the entire road.

Mr. T. H. HABERKORN, Master Mechanic of the Fort Wayne, Cincinnati & Louisville, has resigned, and Mr. WM. B. MCPHAIL is to succeed him.

Mr. K. COLBRAN has been promoted to the position of General Manager of the Colorado Midland, with headquarters at Colorado Springs.

Mr. W. B. SCOTT, formerly Superintendent of Telegraph, has been appointed Division Superintendent of the St. Paul & Kansas City, to succeed Mr. G. C. MCMICHAEL.

M. EDOUARD EIFFEL, the son of the builder of the famed Eiffel Tower, is now in this country visiting various engineering works. The younger M. EIFFEL is still a student in the Ecole Centrale of Paris, where he is being educated as a civil engineer.

Mr. CHARLES PHINIZEY, of Augusta, Ga., has been elected President of the Western Ry. of Alabama, vice Mr. CECIL GABBETT, who resigned on account of his increased duties as General Manager of the Georgia Central.

Mr. W. J. MCCAMMON has been appointed Master Mechanic on the Colima division of the National Construction Co., having severed his connection with the Mexican National Ry.

Mr. HOLMES BLAIR, Resident Engineer of constructed lines on the Burlington & Missouri, has resigned to accept a position with a mining company at Tucson, Ariz. He is to be succeeded by Mr. G. P. SMITH.

Mr. J. MCGUIRE, formerly Trainmaster of the St. Paul & Kansas City, has been appointed Division Superintendent. He will have charge of the main line from Minneapolis to Elma, to Lyle on the diagonal, and the Wasoja branch.

Mr. JOEL BARLOW MOOREHEAD, iron manufacturer and capitalist, of Philadelphia, died Oct. 25. He was for several years a railway and canal builder, and at the time of his death was the largest holder of the stock of the Monongahela Navigation Co. of Pittsburg.

Mr. W. H. BROWN, who has been elected President of the Cincinnati, Jackson & Mackinaw road, to fill the vacancy caused by the resignation of Mr. J. H. FISHER, is a member of the banking firm of W. H. Brown & Co., but prior to entering the banking business had some experience as a railroad man, mostly through his connection with the contracting firm of Brown, Howard & Co.

Mr. SUMNER S. THOMPSON, of Lyndonville, Vt., died at Frankfort, Mich., Oct. 24, aged 66. He was extensively engaged as a railway contractor, and carried out large contracts on the Grand Trunk. He was director in several railway corporations and a large owner in the Woodstock Road. At the time of his death he was engaged in constructing the Frankfort & Southeastern Railroad in Michigan, and was President of the corporation.

MR. HARRY MONKHOUSE has been temporarily appointed acting Master Mechanic of the Chicago, Kansas & Nebraska division of the Rock Island, in charge of car and locomotive departments, with headquarters at Horton. Mr. RICHARD MCDOUGALL has been transferred to his former position at Goodland. The office of Assistant General Master Mechanic and General Master Car Builder has been temporarily abolished.

Mr. EDWARD DICKINSON has been appointed General Manager of the Missouri River division of the

Union Pacific R. R. Mr. G. M. CUMMING, General Manager of the Mountain division, and Mr. C. J. SMITH, General Manager of the Pacific division. The office of the General Manager of the Union Pacific is abolished. Mr. T. L. KIMBALL, third Vice-President, will be stationed at Omaha. Mr. C. S. MELLEN is appointed General Traffic Manager; Mr. C. H. MCKIBBON General Purchasing Agent in place of Mr. C. S. MELLEN, resigned; and Mr. J. S. CAMERON, Chief of the Construction Department. Mr. KIMBALL has been in the employ of the Union Pacific for about 25 years.

PUBLICATIONS RECEIVED.

—*The Poughkeepsie Bridge and its Connections.*—A souvenir number of the *Poughkeepsie Eagle*. Poughkeepsie, N. Y. 1889.

This is a notable instance of journalistic enterprise and in the excellent character of illustrations, subject matter, and typographical appearance it would do much credit to any journal. The 44 pages of full newspaper size contain the best selection of photogravure views of the bridge, in progress and completed, that we have yet seen. These are accompanied by a general description of the enterprise and portraits of the men interested therein. The bulk of the issue, however, is devoted to setting forth the chief features of the town of Poughkeepsie, its men, its public buildings and its business enterprises.

—*A Treatise on Steam Boilers*, their Strength, Construction, and Economical Working. By ROBERT WILSON, C. E., Late Inspector Manchester Steam Users' Association, etc. Enlarged and illustrated from the 5th English edition by J. J. FLATHER, Ph. B. Instr. Mech. Engr. Lehigh Univ. 12mo. pp. 437, 107 cuts. Fair index, $2 50.

This new edition of an old and standard work calls for no new review. A dozen years ago the work was recognized as of great value. It has been fairly well brought down to date. The revisions are "with Mr. WILSON'S permission," but it is painful to remember that our barbarian laws give him no power to object if he wished to, nor right to reward from those who profit by his labor.

—*Report on Water Supply for Irrigation*, on the Honouliuli and Kahuhu Ranchos, Island of Oahu, Hawaiian Islands. By JAMES D. SCHUYLER and G. F. ALLARETT.

A report containing a great deal of valuable matter on irrigation, especially by pumping the supply. A notable statement is this: "We have permission of Mr. HUGH MORRISON, General Manager of the Spreckelsville plantation, to quote him as giving the deliberate opinion that on good average sugar land one can afford to pay as much as $100 per acre per year for water sufficient to irrigate it abundantly."

—*The Tabor Indicator*. Ashcroft Mfg. Co., New York. Pamphlet, 6 × 9¾ ins., 72 pp.

This pamphlet, issued by the makers of the Tabor indicator for steam engines, contains a useful description of this instrument, its uses, management, and care, and has several illustrations. In addition to the description, there are notes, several pages devoted to the indicator diagram and the information to be obtained from it. The use of the indicator on locomotives, and the method of indicating engines and taking diagrams, with instructions and methods of computation, are also dealt with. A number of testimonials are appended. The pamphlet is a handy and useful publication, and the Ashcroft Mfg. Co. will furnish a copy free to engineers who are using, or who contemplate using, the indicator, and who wish to inquire into its application and judge of the relative merits of the indicators offered by the various manufacturers.

—*Report on European Dock Yards.* By Naval Constructor, PHILIP HICHBORN, U. S. N. Washington, Govt. Printing Office, 4to. pp. 88, 63 folding plates.

A valuable and—in so far as any such publication can be—exhaustive report. It would lead us too far to review the publication in detail, in view of the slight interest which most of our readers have in naval questions. A large part of the work is devoted to descriptions of vessels, but the report is in every way creditable to the author and the details of all the leading European dock yards are very full.

—*Proceedings of the Seventeenth Meeting of the Association of North American Railroad Superintendents*, held at New York, April 8, 1889. C. A. HAMMOND, Secy. B. R. B. & L. R. R. Boston Mass. 8vo. pamphlet. pp. 104, 8 plates.

The most valuable matter in this report is some quite full details as to car-heating, which, however, are already ancient history. The discussion of this subject of train miles, and of a paper on rails by Mr. E. E. RUSSELL TRATMAN, of this journal, were the most important features of the proceedings.

—*Souvenir of the Royal Naval Review and Manœuvres*, 1889. Compiled by J. A. FISHER, Gen. Man. United Asbestos Co. Ld., London.

An interesting compound of an advertisement of an excellent product and of a history of a great occasion. It makes one devoutly thankful that we are not favored with so great a navy—nor oppressed with the need of it—as that of Great Britain.

—*Buckeye Portland Cement.*—Buckeye Portland Cement Co., Bellefontaine, O., Pamphlet, 6¾ x 8¾; 44 pp.

This is a neatly got up little pamphlet containing notes on Hydraulic Cement, Imported Portland Cement, The Materials Used, The Process of Manufacture, The Making of Concrete Cement Walks, Tests of Cement Analyses of the Buckeye Cement

—*Hoisting Blocks.* C. W. Hunt Co., New York.

These two neat pamphlets, of about 75 pages each fully illustrated, describe interesting and novel appliances for hoisting and conveying construction plant, etc., which we have in part already described and in part shall more fully describe shortly.

SOCIETY PROCEEDINGS.

Engineers' Club of Philadelphia.—The regular meeting was held Oct. 19, Vice-President ARTHUR BEARDSLEY in the chair; 15 members and 2 visitors present.

The Secretary presented, for Mr. CONWAY B. HUNT, a paper on "Repairing a Bridge Pier's Foundations." These repairs were made to what is known as Pier No. 1 of the Aqueduct Bridge over the Potomac River. The rock bottom of the river is from 25 ft. to 35 ft. below low tide. After an extraordinary freshet a settlement was discovered, and investigation showed that a cavity had been scoured under the pier, extending the full length of the pier and across its up-stream ends. This cavity was about 4 ft. high and extended about 6 ft. back under the pier. The author then gives a very full description of the manner in which this pier was constructed, from which it appears that all of the masonry had not been extended to the rock. After the first settlement was observed it was found to continue, and repairs were at once begun. These were made by lowering concrete in loosely filled bags, which were packed in the irregular cavity by divers, and by lowering concrete in tubes, which were tripped and the material pushed with hoes and special tools into all the remaining portions of the cavity, until it was completely filled with a substantially solid mass of concrete. The outer surface of the pile of bags was finished with loose concrete. The method of preparing the concrete and doing the work was described. The repairs occupied about 11 working days, and about 110 cu. yds. of concrete were used. The total cost of the work was as follows:

		Total	*Per cu. yd.*
Labor, including superintendence,		$1,394.99	$12.68
Materials,—cement,	$1,105.50		
Other materials,	511.90	1,617.40	14.70
Tug hire and incidentals		99.22	.90
		$3,111.61	$28.28
Rip rap,		1,384.02	
	Total	$4,505.63	

There was some discussion of kindred subjects by Prof. L. M. HAUPT and Messrs. EDWARD HURST BROWN and HOWARD MURPHY.

HOWARD MURPHY,
Secretary and Treasurer.

Montana Society of Civil Engineers.—At the October meeting, held at the office of Mr. BECKLER, Chief Engineer of the Montana Central Ry., at Helena, the reports of committees on memorial to constitutional convention and on irrigation in Montana were read and adopted. Col. DELACY read a paper on the history of public land surveys, and suggested that the entire system as now practised be abolished and that the surveys be made by a corps of engineers as railroad surveys are conducted. This paper was submitted as a preliminary report. Mr. CHAS. G. GRIFFITH was added to the committee on public land surveys, and the committee was directed to report at the next regular meeting. The committee on affiliation with the American Society of Civil Engineers submitted a report recommending that definite action in the matter be deferred, and that a committee be appointed to confer with the committee of the American Society and with the Board of Managers of the engineering societies. The report was adopted, and Messrs. HAVEN, HERRON and KEBL were appointed such a committee.

Technical Society of New York.—The Technischer Verein von New York has recently elected the following officers: President, PAUL GOEPEL, C. E.; Vice-President, E. L. HEUSNER, M. E.; Corresponding Secretary, MAX C. BUDELL, C. E.; Recording Secretary, EUGENE DIETERICH, Architect; Treasurer, CHARLES HEINECKE, M. E.; Librarian, FRANZ KNAUER, C. E.

Chairman of Section 1 (Civil Engineering), WILHELM HILDENBRAND; of Section 2 (Mechanical Engineering), D. P. PALMEDO; of Section 3 (Architects), H. W. FABIAN; of Section 4 (Chemists and Metallurgists), TH. LUNGWITZ. Chairman of Committee for Arrangements, GEO. E. BERNA: for Employment, GEORGE W. WUNDRAM; for Publications, AUGUSTUS KUERTH.

The Society's rooms are at 194 Third Ave., and the office of the Corresponding Secretary is at 20 Nassau St.

Engineers' Society of Western Pennsylvania.—At a recent meeting of this Pittsburg society, Mr. J. S. MCGEHAN, of the Standard Metal Tie & Construction Co., read a paper on "Metal Ties for Railways."

Western Society of Engineers.—At the meeting of this Chicago Society on Oct. 2, Mr. BENEZETTE WILLIAMS in the chair, a paper on "Irrigation in Egypt and the Raijan Reservoir" was read by Mr. COPE WHITEHOUSE.

Arkansas Society of Engineers, Architects, and Surveyors.—The third annual meeting will be held at Little Rock, Ark., Nov. 12, 13 and 14, and a large attendance of members and others is desired, as an endeavor will be made to induce legislation governing the status of the profession in the State. There will be a trip over the dummy railway, and visits to the works of the Pulaski Gas Light Co., the Little Rock Electric Light Co., and the Little Rock Oil & Compress Co. Dr. J. C. BRANNER, the State Geologist, will deliver a lecture, and there will be a banquet Nov. 14.

FRED. J. H. RICKON, *Secretary.*

American Gaslight Association.—The annual meeting was held recently at Baltimore, Md.

Mr. W. H. PEARSON, of Toronto, Canada, read a paper entitled "Conduct of the Electric Light Business in Connection with the Gas Industry." Mr. PEARSON said it would be advantageous for a gas company to manufacture and sell electric light as well as gas.

"The rapid progress which has been made in electric lighting during the past few years," he said, "and which is continually going on at an increased ratio, must of itself be conclusive evidence to any unprejudiced mind that it 'has come to stay,' and that, as at present, it is destined to continue to be one of the principal, though not, in my opinion, the chief lighting agent of the future; for on careful investigation I am satisfied that neither the arc nor the incandescent light can compete with good and cheap gas as the light for the people; and while there are some who can and will have luxuries, or what they consider to be the best at any price, with the general public the question of cost is the factor which has the most weight. To my mind the most important reason for gas companies going into electric lighting business is to head off ruinous competition. The following statement will, to some extent, show the nature of the competition with which they have had to contend: The average price charged per hour for a 16 candle incandescent electric light for commercial lighting in the cities of Boston, Cambridge, Lawrence, Lowell, Springfield and Worcester is 1.28 cts, which is equal to $2.57 per thousand feet for gas of the same illuminating power, while the average price charged for gas in these places is $1.48 per 1000, the average price for nominal 2,000-candle arc lights for municipal lighting all night being 55 cts. The average increase in the consumption of gas in these places over the previous year amounted to 9.47 per cent. These are fair samples of the electric lighting charges made throughout the State where water power is not employed. From these statements it appears evident that gas lighting is more than holding its own in Massachusetts, and I take it to be a fair illustration of the position of the industry throughout the United States, and that incandescent lighting cannot there—at all events, in the larger cities—begin to compete with gas in prices. Whether or not electricity at the prices charged in Massachusetts, is paying does not appear, as there is no statement in the report referred to of dividends paid by electric light companies, as in the case of gas companies. This of itself is suspicious, and if fair dividends were paid, it is not likely that the fact would be suppressed." The speaker did not think it advisable for a gas company to go into competition with electric lighting with an already established electric light company.

Mr. S. G. STINESS, of Massachusetts, said the electric light companies in Massachusetts were rapidly increasing. He believed that electric light companies pay in many places and compare favorably with gas companies.

Mr. T. LITTLEHALES, engineer and manager of the Hamilton, Ont., gas company, said he was going into electric lighting. Mr. ROBERT BAXTER, of Halifax, advocated gas companies running electric lights. President MCMILLIN told of electric light companies in St. Louis, Mo., which make 18 to 20 per cent. per annum.

Mr. T. G. LANSDEN, of Washington, D. C., read a paper on "The Advantages of Supplying a Mixture of Coal and Water Gas." He thought the most satisfactory gas of the future would be 60 per cent. coal gas and 40 per cent. water gas.

ENGINEERING NEWS

AND

AMERICAN RAILWAY JOURNAL.

Published Weekly at Tribune Building, New York.

VOL. XXII. Saturday, Nov. 2, 1889.

D. McN. STAUFFER A. M. WELLINGTON
EDITORS.

CHAS. W. BAKER E. E. R. TRATMAN M. N. BAKER
ASSOCIATE EDITORS.

GEO. H. FROST . . . . . BUSINESS MANAGER

SUBSCRIPTIONS.

To United States, Canada, and Mexico.

One Year, **$5.00**; *6 months,* **$2.50**; *3 months,* **$1.50**; *Single Copies, 12 cents. To all* **Foreign Countries** *in the Postal Union, add $2.08 to above prices for postage.*

CLUB RATES.

Two new subscriptions	$9.00
One renewal and one new subscription	9.00
Five new subscriptions	20.00
One renewal and four new subscriptions	20.00

Subscribers *can have the mailing address of their paper changed as often as they desire. Send both the old and the new addresses.*

The date *when the subscription expires is on the address label on each paper, the change of which to a subsequent date becomes a receipt for remittance.* **No other receipt** *is sent unless requested.*

Advertising rates. 20 cents per line *agate measure. Schedule sent on request.* **Changes** *of advertisements must be in hand on Tuesday afternoon;* **New** *advertisements Wednesday afternoon;* **Transient** *advertisements not later than Thursday noon. The last pages go to press early on Friday, and we will be obliged if parties who fail to receive their papers promptly will notify us without delay.*

Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty, or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

Coming Technical Meetings.

Engineers' Club of Philadelphia, Pa.—Next meeting, Nov. 2. Secy., Howard Murphy, 1122 Girard St.

Engineers' Club of Kansas City, Mo.—Next meeting, Nov 4. Discussion on Sewerage Systems. "Plan for Outer Harbor off Padre Id., Coast of Texas," J. Willett and L. M. Haupt. Secy., Kenneth Allen, 209 Baird Building.

Engineers' Club of St. Louis, Mo.—Next meeting, Nov. 6.

American Society of Civil Engineers, New York.—Next meeting, Nov. 6. Secy., John Bogart, 127 E. 23d St.

Western Society of Engineers, Chicago, Ill.—Next meeting, Nov. 7. Discussion on the Chicago Drainage Problem. Secy., J. W. Weston, 78 La Salle St.

New England Railway Club, Boston, Mass.—Next meeting, Nov. 13. Rooms in the United States Hotel.

Western Railway Club, Chicago, Ill.—Next meeting Nov. 18. Rooms in the Phœnix Building.

Engineers' Society of Western Pennsylvania—Next meeting, Nov 19. Secy., S. M. Wickersham, Pittsburg, Pa.

Boston Society of Civil Engineers.—Next meeting, Nov. 6. Secy., S. E. Tinkham, City Hall.

New York Railway Club.—Next meeting, Nov. 21. Rooms at 113 Liberty St.

IT is unfortunate that a metal which seems likely to play so great a part in the arts in future as aluminum should have been cursed from birth with a double name, causing everyone to hesitate as to whether he ought to write or say *aluminum* or *aluminium*. So far as weight of authority and usage goes, each form is about equally honored, the balance of early authority rather favoring the simpler form, and present usage the more complex. Sir HUMPHREY DAVY, who discovered and named the metals potassium, sodium, magnesium, and strontium, and who named and suggested the existence of barium and calcium, which were discovered almost immediately thereafter, also suggested that alumina, silica, and zirconia might probably yet yield a metallic base, for which he suggested the names of alum-ium or (later) alumi-num, silicon, and zircon. By analogy with the names of his other metals, however, when WOHLER finally discovered this metal in 1828, it was given by him, or some one, the name alumin-ium, with five syllables instead of four; and this form has now, as we have stated, a rather wider use than the earlier and simpler form, which it tends somewhat to crowd out. The usage of the next five or six years will probably settle the matter. When it is so settled, we too shall accede to it; but as we may have occasion to write and speak the word frequently in future, it would seem desirable that the form favored should be the simpler one, at least while choice is open. We suggest, therefore, that all engineers, chemists, writers, or speakers who have occasion to use the word throw the weight of their authority and example in favor of the simpler form, *aluminum*, which will hereafter be the form used in this journal. The general public, when it begins to use the word, will certainly take most kindly to *aluminum*, and its potent example is likely to be decisive in the end.

THE public notice of the Pittsburg Reduction Co., given in another column, reducing the price of aluminum to $2.00 per pound in 1,000 lb. lots, marks one of the most significant metallurgical advances which we have recorded for many a day. Two or three years ago the price of aluminum was $10 per pound. At the present moment the metal is quoted in the London market at £1 sterling ($4.86) per pound, or was a week ago, and until this notice the quotation here was about the same. The metal is now placed in the market at nearly 60 per cent. reduction from that price in 1,000 lb. lots, and it must be expected that this will ere long be further and heavily reduced, for however cheaply the metal may be produced, there can be no object in so heavy a reduction except to stimulate consumption and demand; $2,000 is not so heavy an investment but that any firm using aluminum at all, in however small quantities, would at once enlarge their stock if they thought the cut was for any other motive, and likely to be only temporary. That one should be able to purchase in the open market 1,000 lbs. of aluminum at any price is really an evidence of a notable metallurgical revolution. In 1883, only 6 years ago, but 69 lbs. of aluminum were manufactured in the United States, at a cost of $12.70 per pound. In 1884 the quantity rose to 124 lbs. and in 1885 to 234 lbs. at a cost of $10.90 per pound: and then began the recent increase, due largely to the perfection of the sodium process, which is now in its turn being left far behind. The quantities are not reported after 1885, but the value of the product increased from $2,550 in 1885 to $27,000 in 1886 and $74,905 in 1887. The figures for 1888 we have not at hand, but the total product this year by the three different reducing processes which are now in practical operation is likely to be several hundred thousand pounds, if we are correctly advised. Thus rapidly has come to the front a new commercial metal, plainly destined to exercise a great influence upon the arts of the future, and having a combination of more valuable qualities than any other metal whatsoever. From various sources of information we gather that the price is quite certain to go still lower in the near future as demand increases, and that before the end of this century it is likely to be below $1.00 per pound.

A CURIOUS idiosyncrasy of the British writer on economics, not unnatural under the circumstances, but sufficiently amusing when its entirely fallacious character is considered, is to regard "trade," i. e., volume of exports and imports, as the index of the prosperity of a country. An example of this tendency we cut from the last number of *Engineering* in the following paragraph:

> It is interesting to note that, for its population, Canada has nearly double the trade of the United States, the figures being:
>
> | | *Imports per capita.* | *Exports per capita.* | *Total Trade per capita.* |
> |---|---|---|---|
> | Canada | $22.03 | $18.14 | $40.45 |
> | United States | 12.03 | 11.58 | 23.65 |
>
> The whole trade of the Dominion during 1888 was $201,097,630, of which $110,894,630 were imports.

We frequently see paragraphs showing in the same way how prosperous the six or eight little Australian colonies are. To see how much real significance there is in such figures, it is only necessary to remember that the wealth of Canada is about the same as that of the State of Illinois, and its population only some 60 per cent. greater, or somewhat under 1-13 part of that of the whole United States. Imagine, then, the United States cut up into 13 different nations or sections, each of the population of Canada, and imagine all the "trade" of each of these sections with the other 12 classed in with its foreign commerce to give its aggregate "trade": what would be the total then? Or, again, each of these 13 sections has an enormous volume of perfectly free "trade" with the other 12, in addition to its own internal trade, and yet it manages to export some $12 worth of commodities to foreign nations. About half the so-called "trade" i. e, foreign trade of Canada, is with these same 13 sections, with which, however, it has no free intercourse, but one obstructed by a very high tariff, and consequently of much less volume than that of the 13 sections with each other: it is certainly not of one quarter the volume, although precise statistics, unfortunately, are unattainable. It ought, therefore, to indicate an equal prosperity, to have a very much larger trade with the rest of mankind, for which it competes on equal terms with the United States. As a matter of fact, however, it has only some $10 per head of true foreign exports and imports, as against $12 per head in the United States.

THE "trade of the world," likewise, is an indeterminate and delusive quantity as ordinarily given. All of Europe, in 1880, had about six times the population and under three times the wealth of the United States, and taking into account the greater industrial activity of the United States, it is not in the least likely that its true "trade" per inhabitant, i. e., average of exchange of products between individuals, was any larger than in the United States. But Europe is divided into some ten great nations and as many more small ones, whose traffic with each other all goes under the name of foreign "trade." Consequently, we find from MULHALL'S "Dictionary of Statistics" that "the trade of the world in 1882" and previous years (i. e., aggregate of exports and imports) stands upon its face as follows, in millions of dollars:

	1840	1860	1880	1882	Per inh't, '82
Great Britain	565	1,500	2,855	2,940	$85
France	330	835	1,695	1,715	45
Germany	280	800	1,575	1,900	35
Rest of Europe	686	1,535	3,455	3,625	..
Total Europe	1,860	4,700	9,580	9,880	$32.50
United States	215	4,685	1,545	1,535	30
Canada	...	.....	.....	250	50
Australia	...	.....	.....	515	170

There would appear to be some error in the last column, which is as MULHALL gives it; but the utterly delusive character of the record, as indicating commercial prosperity, is evident at a glance. For England, which depends primarily on foreign commerce for its prosperity, these records are significant,

CHANNEL BRIDGE,

DESIGNED BY MESSRS. SCHNEIDER & CO. and H. HERSENT. SIR JOHN FOWLER and MR. BENJAMIN BAKER, Consulting Engi

SELECTIONS FROM PLANS ACCOMPANYING PAPER READ BEFORE THE BRITISH ASSO T

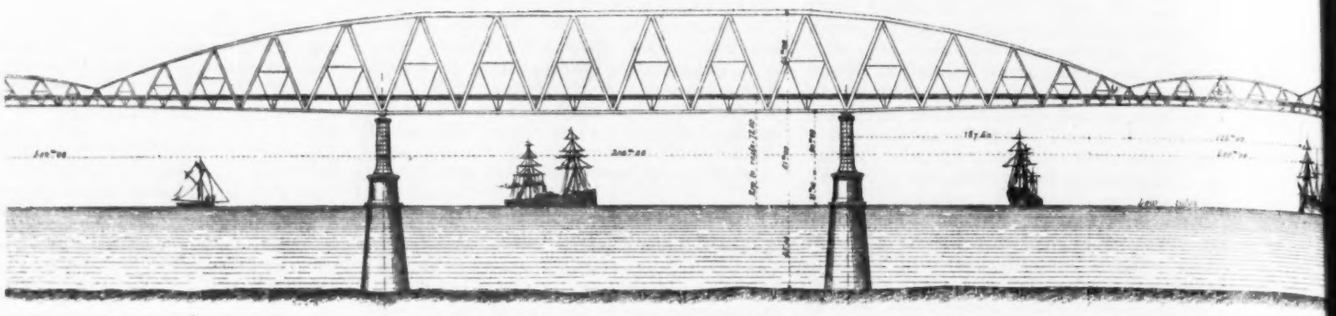


FIG. 3.—SIDE ELEVATION OF BRIDGE SHOWING 300 METRE AND 500 METRE SPANS.

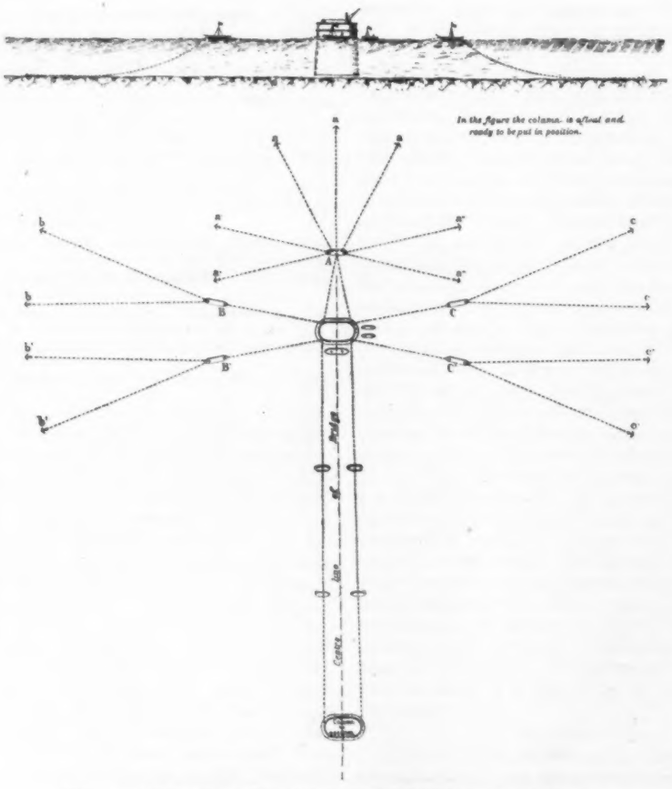


FIG. 4.—METHOD OF PLACING PIER-CAISSONS IN POSITION.

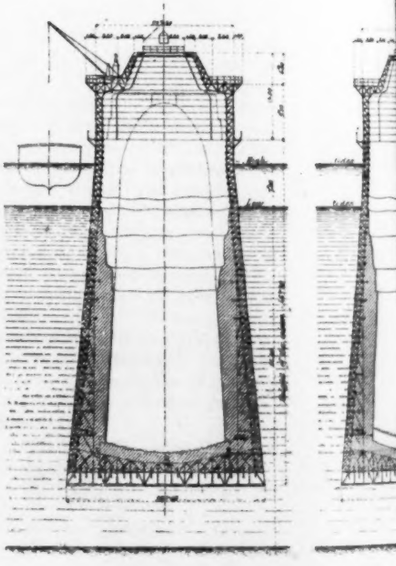
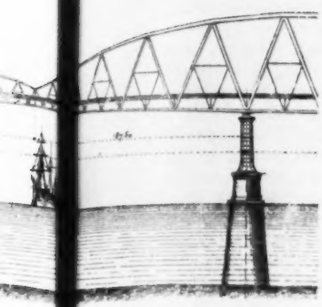
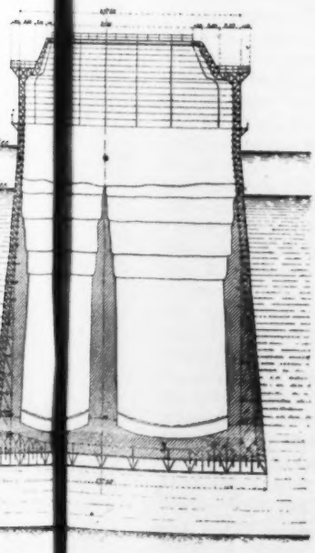


FIG. 1.—SUB-PIERS AND





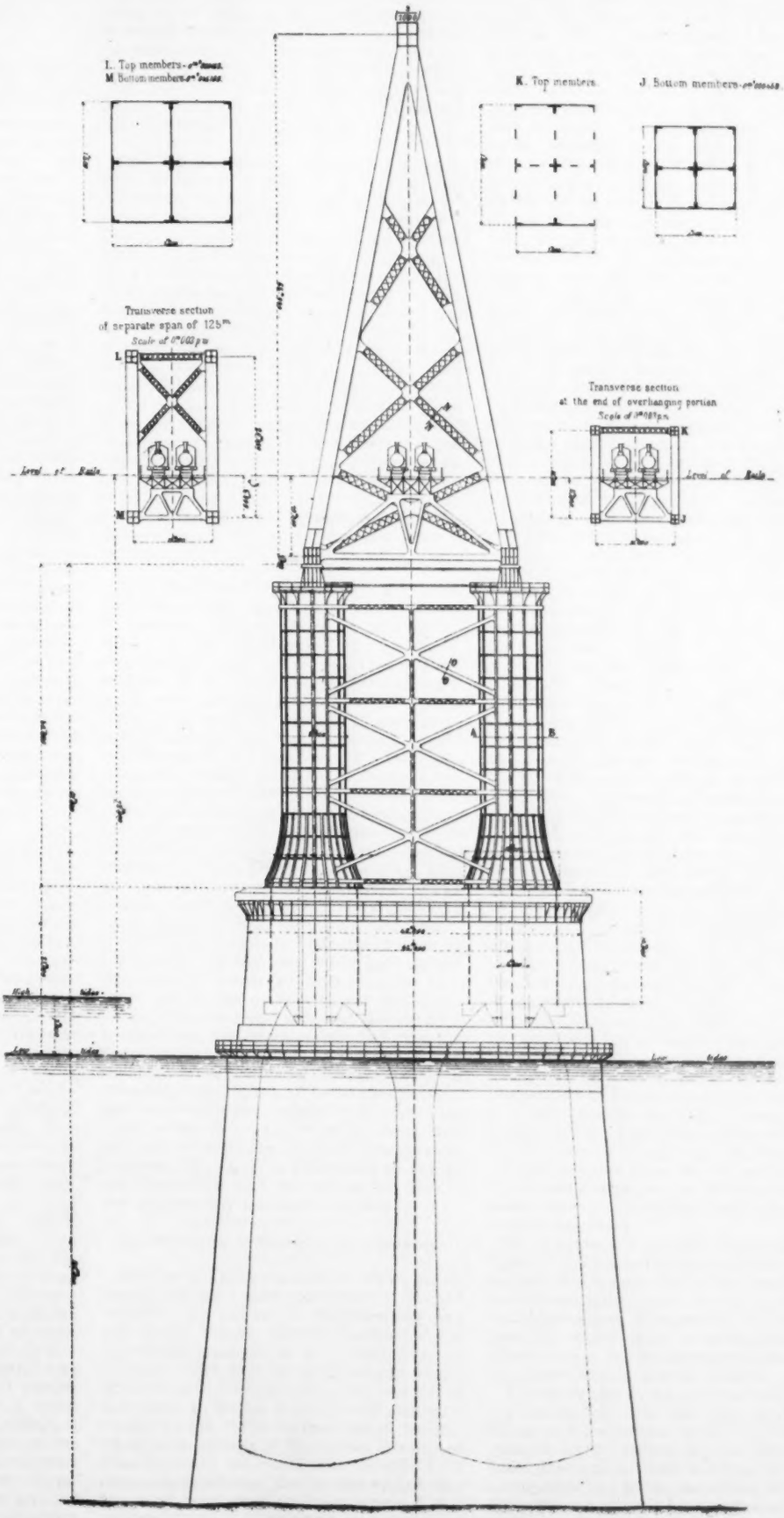


FIG. 2.—ELEVATION OF PIER AND CROSS-SECTION OF BRIDGE.

For the United States, which depends primarily on its internal trade for prosperity, they are in themselves not significant.

THE question raised by Mr. OBERLIN SMITH, in another column, as to the rules which should govern the publication, in the Transactions of scientific societies, of matter tending more or less directly to serve as an advertisement of private interests is a timely and serious one, which it is difficult to see how to answer properly, but which might well have received more attention in the past than it has. Had it been given due weight we are confident that numerous papers which have been published by engineering societies would never have seen the light except at the expense of their author. And yet there have been some of these papers, albeit describing patented processes of private ownership only, which it is well should be of record in such publications, as marking important steps of engineering progress. For reasons well summarized by Mr. SMITH, there is less trouble in this respect among distinctively "civil" engineering papers than among those relating to mechanical, mining, and electrical engineering, many of which will be shown by the most casual examination to have been written to advertise private interests or actually to have that effect. What is to be done about it? Shall the same rule be adopted as is in force in the Master Mechanics' and Master Car Builders' Associations, not even to permit discussions of patented devices, still less papers describing them in detail? To do so would be distinctly unscientific and unadvisable. To take a patent on real improvements is only common business prudence. The improvement is in no way decreased in merit thereby, nor is it the less important that its technical merits should be understood, and made a part of professional knowledge; but that the line should be more strictly drawn than it has been in some cases in the past does not admit of doubt.

MANY engineers and architects have a feeling that there is something *infra dig.* in the taking out of patents by members of their profession, just as there admittedly is in physicians or surgeons taking patents on new medicines or instruments. We do not share this feeling. The two cases are wholly different. The inventions or discoveries of the physician concern human life and health, and hence have no direct and measurable money value. He who attempts to lock them up by private ownership does not simply withhold from his fellow mortals a chance to put more money in their purses, but in effect tells them that he will not save them from death or suffering, unless they pay him money for doing it. How infamous, for example, it would have been in Dr. MORTON, the discoverer of the anæsthetic use of ether, had he patented such use, and denied its benefits to any one who did not pay over a round fee! Yet it would have been within his legal right to do so, and in one sense would have been fair, for his discovery had a value beyond price to those who needed it at all, and no one will deny that it was even more shameful that his great service to mankind should have had so little recognition that his descendants are at this minute suffering for the ordinary comforts of life in New York City. But mankind revolts from the idea of seeking to enforce a profit out of the necessities of the sick and suffering, and so it has ever been held disgraceful to impede the widest possible use of new remedial agents by placing patents upon them. In inventions relating to material matters and improvements in the practical and constructive professions, however, the case is quite different. No one will suffer in mind or body, but only in pocket, if he does not use the best locomotive, or steam roller, or electric motor, or system of sinking foundations or of punching tickets; and the benefits of such new devises being purely financial, it is but right that those who make it possible to so save money or make money should insist on being repaid in kind for their services.

COL. JAMES ANDREWS, of the Tehuantepec Ship Railway Co., informs us that he was incorrectly reported in the newspaper interview, upon which we made some comments lately, in connection with Panama Canal affairs. Col. ANDREWS says he did not report M. BRUNOT as saying that the survey of the canal which he had ordered would be "the first trustworthy survey since the work was begun," nor anything of that kind. M. BRUNOT expressed no opinion at all as to the trustworthiness of former surveys. We take pleasure in making this correction, as far as Col. ANDREWS is concerned. But while the quoted statement was somewhat surprising as coming from the receiver of the defunct canal company, its evident truth gave it currency, especially as it fully agreed with previous reports from canal officials likely to be even better informed than M. BRUNOT as to the real character of the surveys.

THE *Burlington Free Press*, in a late issue, preaches a little sermon on the condition of Vermont roads, taking as its text the advance in the town price of vegetables, owing to bad roads, and the fact that in some sections of that State the farmers are finding it more economical to feed fresh milk to their stock than to attempt to haul it to market through the mud. This is a practical statement of a condition of affairs that means the loss of a market to farmers and enhanced prices to townsmen. The condition of Vermont roads complained of is practically that of every other State in the Union at some time in the year, and it is time that the residents of town and country realized that this annual and permanent loss of actual money could be prevented by a judicious expenditure of legislation and cash in improving the shockingly bad road system of our country. Permanent roads, good all the year around, cannot be built in a day or a year; but to have them at all the whole system must be remodeled, and the location, construction, and maintenance put into the hands of men trained to the business and responsible for their condition, that is, in the hands of engineers. France and England have both made the change, from roads that were as bad as ours now are to roads that are wonderfully good, in about two spans of a human life, and it is a reproach to American civilization that we are as yet hardly making a start in the same direction.

The Progress of Railway Consolidation.

The recent traffic contract by which an alliance "offensive and defensive" is formed between the Chicago & Northwestern and the Union Pacific Railway Companies is a noteworthy example of the consolidation of interests which is going on in railway circles in every part of the country. No one would have been so rash a score of years ago as to predict that in 1890 more than half of the 170,000 miles of railway in the United States and Canada would be owned and operated by a dozen corporations. And to-day we find only the most far-sighted and best-informed railway men aware of the fact that, if present tendencies continue, a few more years will witness the consolidation of all our railways into a half dozen or so great systems, each independent of and competing little if at all with its neighboring systems. The longest steps in this direction have been already taken. It will be but a comparatively short and easy step from the systems of to-day, many of them 5,000 to 7,000 miles in extent, to these greater systems. But the traffic alliance above noted, while important from the magnitude of the interests involved, and as an indication of tendency, should not be unduly magnified, since it involves no financial consolidation and no unity in the operations of the two companies outside of the traffic department. It does illustrate well that the next step in the progress of consolidation is likely to come in the form of alliances of the great systems, which will have to be met with counter alliances. And in time, to oppose this, the original alliance will have to be made stronger.

In that sense, as a premonition of the actual consolidations which are probably coming, the importance of this traffic agreement cannot be exaggerated, and it is well for the public to understand that it has everything to gain and nothing to lose by the progress of such consolidation. As Chairman WALKER of the Interstate Commerce Railway Association shows elsewhere in this issue, in a letter which we advise everyone to read, the provision of the law that all rates shall be "just and reasonable" protects the public even when competition is entirely wiped out. With the progress of consolidation, too, will come the rapid furtherance of needed reforms in methods of operation and the introduction of improved appliances. These are now greatly hindered by the diversity of the interests involved and the poverty of the weaker companies. Consolidation will remove both these evils and will save also the wasteful expenses of competition, which are now no small burden.

The views of the work of traffic associations expressed by Mr. WALKER, in another column, are certainly correct, if we except his rather sweeping statement that they "are not formed for the purpose of restraining competition." If by that expression he means that they are not formed with the hope of stopping all competition in both rates and facilities between the associated companies, he is quite right; but it is certainly true that they are formed to regulate competition, and, indeed, to prevent its operation, in so far as that is possible. It will be of little use to try to persuade the public that this is not the case. The fact which the public needs to understand, and of which it is as yet ignorant, is that this regulation of competition by traffic associations is as vitally necessary as is the regulation of steam engines by a governor. Take away this restraint, and let all traffic be fought over, and rates will inevitably fall to a point where bankruptcy of the weaker companies, and their sale and consolidation with the stronger, will follow in inevitable sequence.

Mr. WALKER'S interesting statement of his views on the general subject of traffic associations, to which he refers in his letter, we intended to publish some months ago, but it was crowded out. It is not the sort of matter, however, which loses its pertinence by the lapse of time, and we print as full an abstract as possible of it in another column.

For the benefit of those of our readers who are unfamiliar with the English Clearing House and its relation to railway traffic and rates in Great Britain, we will give later a brief description of its working in our editorial columns. In the meantime let us conclude this article by a brief glance at the pros and cons of the general question of railway consolidation on the great scale which events indicate to be coming.

It cannot be denied that the European precedents are not particularly encouraging. England and France, to go no farther, are already parcelled out geographically between five or six great companies, the one by like natural tendencies to those which are operating here, the others by governmental action. The result on rates is not on its face satisfactory, it must be admitted. Rates of all kinds are very high in both those countries and throughout Europe, as compared with the American standard, which has grown up under practically free competition, and with little or no governmental control; for even State control is a modern thing, and has never been very effective. But there are reasons for this difference quite apart from the apparent one just mentioned. There has been, in the first place, a cheaper and on the whole more rational standard of location and construction in this country; the interest account has not been so excessively great. There has been, in the second place, a greatly longer average haul, in the ratios of 3 or 4 to 1, naturally justifying far lower rates. In the third place, there has been an enormously rapid growth of traffic here, doubling every 8 to 10 years, which is quite without parallel in Europe, although there also the traffic has grown rapidly. In the fourth place, there has been, and will always be, a more direct and more effective water competition here than exists in any other great country. In the fifth place, there is the difference in the character of the people, making the progressive tendency more decided; and finally, and perhaps before all other causes, there has been an enormous bulk of long-haul agricultural products, which had to be handled at increasingly low rates to be handled at all, and which necessarily influenced by sympathy all other rates.

All these causes conjointly seem quite sufficient to account for our exceptionally low rates, without counting the effect of competition, which combination tends to make impossible, and which, as we hold, must become impossible to insure stability and equity in rates. It would be idle to deny that there will be something lost by abolishing the free and reckless competition of the past: there generally is some loss with every gain; but that such a change is likely to result in any decided check in the tendency to reduce rates to the lowest paying point, we do not believe. It is notable that even in England, with all its high rates, and with practically no governmental control of them, few companies make dividends of more than 5 or 6 per cent.

On the other hand, besides the great gain in stability, uniformity ,and equity of rates, which is quite certain to result, and which is vastly more important than mere lowness of rates, there should be a great gain in some important administrative matters, like the introduction of automatic freight brakes and couplers, steam heating from the locomotive, and even interlocking and block signalling. The gain in the details noted is obviously important, and in a measure it obtains with every form of betterment, for the reason that there is some one to hold responsible; it becomes no longer possible to hold back, waiting for one's neighbors to do the experimenting and set the example. It is but natural that it should be so now, because every manager wishes to let all his neighbors get their cars equipped with new brakes and couplers, for example, before he equips his cars. He thus at once saves interest and possible errors, and shortens the transition period, during which there is no gain, but rather loss.

As respects the question of administering such vast systems, the main difficulty is already past. Half a dozen of our railway systems are already so vast that the general manager is only a manager of managers, not of the system itself in any proper sense, and it will be but a step further in the same direction when three or four of these great systems are consolidated into one. In fact, if the present continual difficulties about adjustment of rates and other common questions are at the same time done away with, the management becomes simpler than before, for the greater part of the time of the higher managing officials is now taken up with just those questions. The greatest obstacle of this kind to railway consolidation was reached and passed long ago, when systems of over 1,000 miles began to be common. The first railways were 50 to 200 miles long, and the "superintendent" knew personally every important employé on them. Then came the "general superintendent" era, with systems of 300 to 600 miles, and the supervision of the highest official was still tolerably direct, and extended into all important details. With the expansion to the earlier "general manager" era of 1,000 to 2,000 mile systems came the most violent change in the details of management, and now that this is already expanded into systems of 5,000 to 7,000 miles or more, it involves no real increase in the burdens of the highest officer to expand still further into systems of 20,000 to 30,000 miles. We do not say that such systems are coming, but we do say that all the signs point that way, and that the present indications are that greater gains than losses will result.

CORRESPONDENCE.

The Duty Test of the Pearsall Hydraulic Engine.

TO THE EDITOR OF ENGINEERING NEWS:—

I was interested in the description of the Pearsall hydraulic engine in your issue of September 28. I would like to inquire if the method there given of computing the performance of the engine is correct. It is my impression that it is not. The engine is placed at a certain distance below the level of the dam, and the water flowing down to it imparts a force that is capable of lifting a portion of the same water to a height considerably above the original level. If we put a pump to do the same work, we would simply measure the height to which the water was lifted above the source from which it was taken. It seems to me that in comparing the performance of the Pearsall engine with that of a pump the same data should be taken. The fact that by the peculiar operation of the machine the water is first carried to a lower level has nothing to do with the case. The work done, and the work to be measured in comparison with that of a pump, is the lifting of a certain quantity of water from the level of the dam and delivering it at a certain height above that level. From the data accompanying the description, then, the water is lifted not 92.7 ft. but 92.7 ft. — 17.25 ft. = 75.45 ft. and the percentage of power realized is not 71 but 58. Am I right? If a train leaves Utica and runs directly west 75 miles and another train first runs 17 miles east and then 92 miles west, is the latter train 17 miles nearer Buffalo than the former?

FRANK RICHARDS.

[On reference to the article describing the tests of the Pearsall engine, we find one or two typographical errors which may have misled our correspondent. The method pursued, however, and the efficiency given (71 per cent.) is correct, according to the figures given to us by the engineer in charge of the test. Our correspondent himself makes the error of omitting entirely the friction head in the delivery main, which will change the efficiency to 67 per cent. instead of 58 per cent. as he puts it, when figured according to his method.

But if Mr. RICHARDS will examine the matter a little more carefully, he will probably be satisfied that the method originally given was the correct one. He will certainly concede that the efficiency of the machine is the percentage of the total power applied which is utilized in doing work. The friction of water in the pipes which lead to and from this or any other machine has nothing to do with the efficiency of the machine itself.

Now, by the construction of the Pearsall engine, the total power applied is evidently the power of the total amount of water passing to the machine. This amount is 1,026.8 galls. per minute (901.8 galls. escape at the waste-valve and 125 galls. are forced into the delivery pipe). The head under which this amount of water is delivered is 17.25 ft. Then the total power applied is 17,712 3 ft galls.

Next consider the work performed. It is to take a portion of this water and force it against an actual head of 100.61 ft. (statical head — 92.7 ft.; friction head — 7.91 ft.) The amount forced against this head is 125 galls. per minute; hence the work done per minute is 12,576.25 ft. galls., which is a little over 71 per cent. of the total power applied. Our correspondent will notice that the difference between this method and his own is much less than his computation indicated.

In the case of a pump, which our correspondent suggests for comparison, if the supply water were taken from an elevated source, it would press directly upon the pump piston and lessen by so much the pressure against which it worked with no loss of efficiency whatever. In the case of this machine, the actual pressure against which the machine works is that in the delivery main. The pressure of the water in the supply pipe acts in a way entirely different from its action in a pump. It is the force which works the machine, and is to be treated in the same manner as the external force which drives a pump.—ED. ENG. NEWS.]

The Work of Traffic Associations.

Interstate Commerce Railway Association.
Office of the Executive Board.

CHICAGO, ILL., Oct. 23, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

My attention has been called to a thoughtful article in your issue of Oct. 19, page 374, on the subject of Traffic Association. I take the liberty of sending you a copy of an interview upon that subject, the publication of which I authorized a few weeks ago. I am thoroughly satisfied that the administration of the Interstate Commerce Law will prove a failure unless distinct recognition is given to the work of railway associations; and, further than this, I believe that legislation should provide machinery for the enforcement of agreements made in this manner between railroad companies, upon the general plan, in which the decisions of the Railway Clearing House in England are given the effect of judgments by the courts. It is no doubt necessary, as you say, that the public should be disabused of various erroneous impressions which have been formed concerning the work of these associations, and should be made to see that they are not antagonistic to the public interest, but, in fact, are essential to a proper management of railway traffic; and that unless they are efficiently supported by the authorities, results will necessarily follow which will prove disastrous, not only to the roads but to the community at large. I have watched their operation carefully for two years and a half, and I am satisfied that of the business transacted at association meetings a very large percentage, probably nine-tenths, relates to propositions for a reduction of rates. The constant claim is that lines are discriminated against in their traffic and that industries are unfavorably affected, for which a remedy in the way of reduction in rates is demanded. This claim is made upon the recognized principle that every line is entitled to participate on equal terms in all business which it can reach. Traffic associations are not formed for the purpose of restraining competition, nor for the purpose of advancing rates beyond what is just and reasonable. They are not within the prohibition of the Missouri statute to which you refer. It is time that the false impressions which prevail in respect to their character and work should be corrected, and there is no occasion for any avoidance of publicity, but, on the contrary, it should be courted. Yours truly,

ALDACE F. WALKER,
Chairman Interstate Comm. Ry. Asso.

[We publish in another column the substance of the interview refered to in this letter, and also discuss somewhat the general questions raised by the letter editorially.—ED. ENG. NEWS.]

A Faulty Roof Plan.

GIRARD, KAN., Oct. 23, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

Enclosed find roof plan and section of same of the roof intended for the Girard Courthouse. In the absence of a strain sheet, and the architect having left this city, the contractors, whose superintendent I am, consider the construction faulty and unsafe. Under the advice of engineers here, I submit the same for your opinion in your paper. If unsafe, what is the cheapest way to remedy it? The following are some of the main features. It covers the courtroom 57 ft. 4 ins. square

and is supported by 16 in. brick walls, 24 ft. high from the floor of the second story; and has a gallery, with a seating capacity for 400 people, around three sides of the room, hung on rods from the roof. The top of the brick wall is covered by a square frame of 8 x 12 timber bolted to the brick work. In the middle of each wall the timber is spliced by a

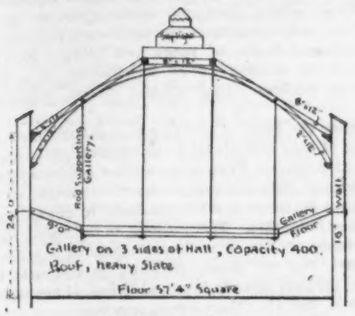


Fig. 1. Section.

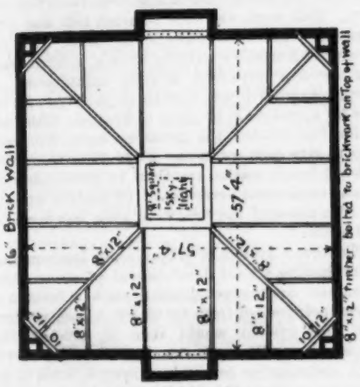


Fig. 2. Roof Plan.

A Defective Roof.

common splice. At the corners there is a cross-piece of 10 x 12 yellow pine to clear chimneys and against this the ends of the two main truss timbers are placed. The frame in center of roof is 18 ft. square and supported by 8 x 12 sticks as shown on roof plan. Between these 8 x 12 the 2 x 12 joists are placed, forming the foundation for the arched ceiling and supported by brick skewbacks in the walls below the skewback of the truss. The roof is to be best style slate, ceiling to be plastered.

If you consider the plan worthy of explanation in your paper, we would be glad to see it in next issue, and if not, at least let us know, either through your paper or otherwise, its faults if any.

Yours truly,

JAMES S. JAMES.

[The design is exceedingly faulty and unsafe, and the cheapest way to remedy it, and the only proper one, is to engage some competent civil engineer or architect to correct its defects before construction is proceeded with. This journal cannot undertake to act as a gratuitous consulting engineer in such cases. After disaster has occurred, we always endeavor to point out defects of design in full, and gratuitously, in the interest of public safety. To so advise in advance, other than to give warning of defects, is quite a different matter.—ED. ENG. NEWS.]

Notes and Queries.

MANY INQUIRIES. A. G. MENOCAL, Chief Engineer, 44 Wall St., New York, is the proper person to apply to in reference to engineering positions on the Nicaragua Canal; but the company is not sending down, and is not likely to send down, many engineers for the work, owing to the fact that there is little for engineers to do after the preliminary work is done, the enormous magnitude of the cuts and sections, as compared with railway or other construction work, making a comparatively small staff of engineers for construction quite sufficient. We are confident the company must already have a hundred applicants for every probable vacancy.

T. D. S. Either *aluminium* or *aluminum* is entirely proper, but the first bids fair to become standard. Sir HUMPHREY DAVY, who discovered the allied metals, potassium, sodium, etc., and suggested the existence of aluminium, proposed the form *alumium* and then *aluminum*. How the third form, *aluminium*, came in we cannot say, but it is now more used than any, probably by analogy with potassium, sodium, calcium, etc. The final discovery of the metal was reserved for WÖHLER, in 1828, although we find Sir HUMPHREY DAVY credited with it in the new Century Dictionary, and with some justice (although the credit is doubtless an error), as he made its existence almost a certainty.

Aluminum.

At the late meeting of the British Association two papers on aluminum were read. One was on the Cowles process as used at the works at Milton in Staffordshire, which works can turn out in 24 hours 2,300 lbs. of 15 per cent. aluminum bronze and 1,800 lbs. of 10 per cent ferro-aluminum: a total of 410 lbs. of aluminum. This paper stated that aluminum bronze had great tensile strength. One 11 per cent. bar gave 57.24 tons per sq. in.; another 7.5 per cent. bar broke under 36.78 tons. It is said to equal the best steel under tests for resistance to compression; and its transverse strength is forty times as great as brass. It can be worked at red heat like iron. But with more than 11 per cent. aluminum, the bronze becomes brittle.

The second paper was by Prof. BEDSON on "Aluminium from Cryolite," as made at the Alliance Aluminum Works. These works made sodium and aluminum, reducing the first from caustic soda by carbon. This sodium is then used to reduce cryolite, which latter is a double fluoride of sodium and aluminum. The cryolite, mixed with common salt, is fused in a reverberatory furnace, then run into an iron converter, and in this last a 5-lb. lump of sodium is thrown and stirred in. The reaction is violent, but less so than is usually supposed. The resulting products are fluoride of sodium and a 90 per cent. aluminum, alloyed with iron and the silicon in the cryolite. The fused salts running off are again treated with sodium, and yield a 98 per cent. aluminum maximum. The mass is then allowed to solidify in an iron mould, in the bottom of which a button of aluminum is found covered by a gray slag of undecomposed cryolite, chloride, and fluoride of sodium and finely divided aluminum. The remnant of the desired metal is secured by fusing the slag with copper in a reverberatory furnace.

It was stated that LUDWIG GRABAU, of Hanover, recently proposed to start with aluminum sulphate and powdered fluorspar. The products are gypsum, which is filtered off, and a body, $Al_2 SO_4 Fl_4$ in solution, to which cryolite is added. This mixture is dried and heated to redness and extracted with water. The residue is crude aluminum fluoride, which on being heated with sodium yields half of the aluminum as metal, and a cheap artificial cryolite $Al_2 Fl_6 6Na Fl$. This process would make manufacturers independent of the Greenland natural cryolite.

The Channel Bridge of Messrs. Schneider and Hersent.

(WITH INSET PLANS.)

The bridging of the English Channel has again been brought prominently forward in the elaborate paper of Messrs. SCHNEIDER and HERSENT lately read before the British Association. The accompanying plans and brief general description are abstracted from an official copy of the paper, which is in itself very detailed and voluminous:

The total length of the bridge would be 24½ miles, with 118 piers and 2 abutment piers. The deepest water is 180 ft., while the bottom formation is blue and white chalk capable of supporting a load of 10 tons to the square foot. Commencing with the pier foundations as the most difficult and interesting feature of the work, Fig. 1 shows them to be made up of caissons with a double shell internally braced. These caissons are cut up into chambers of 50 or 60 sq. m. each in side surface, and each chamber is fitted with apparatus for filling with compressed air when this is required. The bottom is 6 ft. 6 ins. high, from cutting edge to the roof, with an open base. The roof is formed of deep beams filled in with concrete. As it is possible for divers to work in 164 ft. water, it is believed that this bottom can be used as a working chamber in nearly all the piers. In any case, the bottom can be filled with concrete delivered to it by properly located tubes. These caissons have circular ends, and the extreme length would be 187 ft. and extreme width 108 ft.; these dimensions varying, of course, with the depth. The top dimensions are 155.8 ft. by 73.8 ft.

The placing of these piers will be the troublesome part of the plan, and here the engineers rely upon the experience at Toulon, where it was found possible to keep masses of brickwork, aggregating 100,000 tons in weight, afloat in caissons for several months. This plan is to be adopted here, and the caissons will be built and partially loaded in specially constructed ports on either coast of the Channel, and floated out to their site. By means of compressed air chambers in the caisson-skin, the piers may be even lifted again and re-located, should this be found necessary. The foundation masonry would be rough quarry limestone laid in Portland cement, starting from a 6-ft. bed of concrete covering the roof of the working chamber. The manner of anchoring and adjusting the piers in position is shown in Fig. 4.

Fig. 2 shows an elevation of a complete pier and its foundation and also a cross-section of the superstructure at the pier. The masonry pier would extend 21 m. (68.9 ft.) above low water and be surmounted by two steel, cylindrical piers varying in height between 131 and 140 ft. to the seat of the truss. The clear headway under the trusses would be 177 ft. at high water. Each column is formed of two concentric circles having diameters of 15 ft. and 21 ft. respectively. The outer stiffeners give the columns an apparent extreme diameter of 26.24 ft. The inner tube has a prolongation of 46 ft., and 13.12 ft. in diameter, which anchors the column to the masonry. But as an additional precaution against wind-pressure twelve 10-in anchor bolts are added. The load is transmitted from the floor of the bridge to the piers by pedestals and then distributed over a built up covering plate 20.3 ft. in diameter and 4.6 ft. deep.

The bridge would not cross in a straight line from Folkestone, on the English side, to Cran aux Œufs, below Cape Gris Nez, on the French side. To utilize certain banks near the center of the Channel, two angles are made in the line of the bridge, making a bow in it towards the south, with a distance of 5,140 m. between the angle points, each of which would be marked by a large abutment pier. The spans vary in length from 250 to 500 m. (492 ft. to 984 ft.); but the general design calls for a short span of 250 to 300 m. between two cantilever spans of 425 to 500 m., so that the short and long spans alternate across the Channel. The bridge itself would be double track, 26 ft. 3 ins. wide on the floor proper, but with a distance of 82 ft. 3 ins. between trusses as a maximum at the pier points. The trusses would be of simple design, as shown in Fig. 3.

The trusses are to be built on shore at Ambleteuse, and to there await a favorable moment for being floated out and lowered down on the piers. The barges will be brought under the bridge at low tide, allowed to rise, and the truss lowered down by winches and hydraulic presses. Three barges will probably be required for the spans of 300 m., with 50 m. of overhang at each end, with a total displacement of about 5,500 tons. With this part of the bridge resting on the piers, the remainder will be built out by the method followed at the Forth Bridge and other structures of like nature. The suspended spans will be built on shore and hoisted into position.

The following is the summary of a series of tables of estimated weights of the various members of the bridge:

Spans.	Aggregate length.	Units. W'ht in tons.	Totals. W'ht in tons.
32	300 and 500 m.	18,348	587,136
13	200 and 350 m.	8,945	116,285
14	100 and 250 m.	4,846	67,844
Total weight in tons for whole bridge			771,265

The total length of compound spans given above is 37,656 m., or 123,428 ft., and the average weight per lineal metre of bridge is 20.5 tons, or about 6.2 tons per lineal foot. In estimating this weight 18 per cent. was added to the calculated weights to provide for the riveting and fitting. Taking all parts together, the limit of stress was assumed of 12 kilos per sq. millimetre of section, or 7.6 tons per sq. inch. As the structure will be all steel, this is not considered high. In this bridge the permanent load represents 8-11 of the total load.

The estimated cost of the masonry portion is 380,000,000 francs, and of the metal superstructure, 480,000,000 francs, a total of 860,000,000 francs, or $172,000,000.

Express Trains in Germany and on the Continent.

In response to an official demand regarding comparative speed of express trains, the German Minister of Public Works declared lately that the German express trains now surpass in speed those of the other continental nations, and he feared that if the speed was increased, the people would hesitate in utilizing the railways. *Le Génie Civil*, in a late issue, believes that the German Minister is somewhat deceived in making this affirmation, and submits the following table to show that the North German railways by no means occupy the first rank in this respect:

Country.	No. of English miles run each day.	Mean velocity per hour in English miles.		No. of inhabitants corresponding to a daily run of 1 mile
		With stop.	Without stop.	
Great Britain	62,574	41.66	44.60	525
Holland	8,000	32.50	35.	540
Belgium	6,919	31.75	33.50	850
France	41,130	32.80	36.20	920
North Germany	25,598	31.75	34.33	1,250
South Germany	9,025	31.30	33.	1,250
Austria-Hungary	13,832	30.	32.	2,400
Italy	4,765	29.50	31.75	2,820
Russia	3,000	29.	31.66	27,700

This table is followed by another which compares the rates of first-class and second-class fares over a common distance in the various countries:

	1st class	2d class.
Great Britain	$0.40	$0.25
Holland	.32	.28
Belgium	.29	.20
France	.38	.28
Germany	.34	.26
Austria-Hungary	.36	.26
Italy	.40	.34
Russia	.46	.34

The chief points in these comparative exhibits seem to be taken from the excellent English work of Messrs. E. FOXWELL and T. C. PARKER, entitled "Express Trains, English and Foreign."

Railway Traffic Associations and the Interstate Commerce Law.

Some time ago, when considerable was being said in the public print concerning the so-called "railway trust scheme," Mr. ALDACE H. WALKER, the Chairman of the Interstate Commerce Railway Association, gave out for publication one of the clearest explanations of the work done by railway traffic associations which has ever been published, explaining particularly the office and work of the Association of which he is at the head.

To more fully explain the statements made in a letter from him, published in our correspondence column, we give below an abstract of the interview above referred to, as forwarded to us by him, condensing it as little as possible.

The first annual report of the Interstate Commerce Commission pointed out a variety of ways in which agreements among railroads were required for the handling of joint traffic in the manner contemplated by the law and demanded by the public. It was there shown that joint tariffs, joint running arrangements, the interchange of cars, the division of through rates, the apportionment of expenses and losses, and the giving of credit to a large extent were required, which could be best settled and adjusted by the voluntary action of the parties in control of the various roads. Associations were formed for such uses, to which all common interests were remitted. Classification was confided to them, for the reason that differences in classification were serious obstacles to a harmonious and satisfactory interchange of traffic; and, beyond all this, a fact which largely influenced the formation of such associations and the conferring upon them of extensive authority, was the liability constantly imminent that destructive wars of rates would spring up between competing roads, to the serious injury of the parties and the general destruction of business.

Since the passage of the act, railroad associations have been continued in existence in all parts of the country for the above and many other legitimate objects; their administration has usually been intelligent and progressive, and they have been of much assistance to the Commission in the enforcement of the law.

Undoubtedly one of the purposes of association among carriers is to furnish a forum or meeting place where rates, rules, and regulations governing the transportation of joint and competitive traffic can be arranged and established by concurrent action, and where all the elements attending the fixing of rates by one or more of the lines may be given due force in reaching the resultant. In this correlation of forces the most direct and economical route dominates the rest. The result is the establishment of the price of transportation in a manner similar to that in which commodities are valued in the world's exchanges. The lowest offering in the sale establishes the quotation in the market.

Nevertheless, each seller seeks the best price that he can obtain, compatible with the disposal of his goods. If the ruling rate thus fixed for transportation is not a reasonable one, the Act to Regulate Commerce provides an efficient control, which the Interstate Commerce Railway Association distinctly invites. In this respect a consolidated ownership of railways would radically differ from the usual manufacturing or producing "trusts." The latter are practically without control; while Congress has already established an enactment that railway rates must be just and reasonable, and has provided machinery for its enforcement.

Competition cannot be preserved unless the necessary agencies for competition are maintained. To turn loose upon the same field several wealthy corporations, with the requirement that they must forever compete and never combine, would presently result in the extinction of some, and the survival would not necessarily be of the fittest. Adequate railway service requires the maintenance of the road and its equipment in the most perfect and efficient form. Good public service cannot be rendered without rates adequate to this end, and adequate also to insure the continuance in the field of the necessary capital. Whenever carriers fail to harmonize their conflicting interests by the adoption of corresponding tariffs, a war of rates ensues, and in every rate war the public as well as the carriers must suffer. The person who regards the important object of governmental regulation of railways as the procurement of lower rates has not passed beyond the primer in his study of the subject. Passengers, shippers, and the public generally, are interested in safe and efficient railway service more than extremely low rates. Rates may be so ruinously low as to render such service impossible. They may easily be so low as to destoy competition altogether, by destroying the agencies for competition. The public is best served by rates which are reasonable, uniform, and stable. English tribunals have affirmed healthy competition to be that in which various transportation routes are kept on foot which are "practically independent of one another, fairly alternative, and reasonably calculated to keep one another in check." Yet competition in rates is practically unknown in England.

Association among carriers is therefore required by sound public policy. It enables necessary rules and systems to be formulated for the interchange of traffic; it makes possible the handling of traffic competition between localities without preference or discrimination; it establishes rates co-ordinated with the value of service, and adjusted to the expenses of the shortest routes; it assists to preserve all lines in competitive existence; and it affords an organized support to the enforcement of the regulative statute. Association is the servant of the law. Its existence is assumed as an indispensable agency in the establishment of just rates, fares, and charges. Without it, there can be no adjustments of tariffs to sustain the provisions of the law: the law implies it is a necessary prerequisite.

The breaking down of the present efforts among carriers to conduct their traffic by associations subordinated to the law would inevitably produce one of three results: Either a state of chaos would follow, in which bankruptcy on the part of many lines would ensue, and a commercial panic necessarily be precipitated, with infinite loss throughout the entire country; or, second, it would be necessary for the State to intervene and assume the entire control of railway management; or, third, a common ownership of railway property might secure the harmony essential to maintain their operation in the public service.

No one would admit the desirability of railroad bankruptcies; few would support any project for State control; combinations of railroad owners would be the most natural result of the failure of the present experiment in the statutory regulation of railways through the assistance of railway associations. As has been well said, unless railway managers can associate, railway owners must combine. The most efficient promoters of combination in railway ownership, which are designated somewhat in derision as railway trusts, are those who seek to break down railway associations.

EARTHQUAKE SHOCKS were felt in South Rawdon, Nova Scotia, Oct. 20, and in the city of Mexico, Oct. 28.

The Department of Public Works of France at the Exposition.

In a special building at the Paris Exposition there is an extensive and most interesting exhibit of the French Department of Public Works. The extent of these public works is made plain by plans, models, and voluminous statistics, arranged under the general heads of roads and bridges, internal navigation, marine works, lighthouses, and coast signals, railways, geographical charts, statistics, etc.

Under the head of geology it is stated, in an account of this exhibit in *Le Génie Civil*, that a geological survey of France was authorized by a decree of October, 1868, and put under the direction of M ELIE DE BEAUMONT, who remained in charge until his death in 1874. The geology is indicated upon the maps of the War Department to a scale of 1 80.000. Of 267 sheets required to complete the work, 110 have already been published, 21 are almost finished, and the others are in progress.

France was the first among the great nations to determine the surface elevations over its entire territory. This work was done between 1857 and 1864, under the engineer BOURDALOUE. Since then the majority of European nations have a similar work more or less advanced toward completion. A French commission was appointed in 1878 to fix the bases for a general re-leveling of France. This commission has divided the territory in such a manner as to give each commune 12 to 15 precisely established bench-marks, and then to establish upon maps of large scale every detail of surface undulation. To this end the following plan has been decided upon:

(1) To form a system of triangles, or fundamental system, having a total development of about 12,000 kilom., and cuttingeach other in such a fashion as to form polygons of from 400 to 500 kilom. contour each. This system would then be leveled with the greatest precision possible. (2) A system of the second order, or an intercalary system, with a development of about 800,000 kilom., embracing water courses and ways of communication. (3) A series of contours connecting the preceding systems and near enough together to exactly define the configuration of the ground.

Train Electric Lighting.

At the eighth annual meeting of the Association of Railway Telegraph Superintendents, at Washington, D. C., Mr. CHAS. SELDON, Superintendent of Telegraphs of the Baltimore & Ohio Railroad, read an interesting paper, giving the cost and characteristics of the principal systems of train lighting by electricity now in use.

The author described the difficulties he had found in obtaining authoritative data, and explained that the figures to be given by him as to cost were the maximum. He classed the different methods of train-electric lighting in three systems as follows:

1. Lighting cars by the joint use of dynamo and storage battery.

2. Lighting cars by means of direct current from the dynamo.

3. Lighting cars by means of a charged storage battery.

System No. 1 is in use by the Pullman Palace Car Co. upon its limited New York and Chicago trains, the vestibuled trains of the Atchison, Topeka & Santa Fé Railroad Co., and others. The following is its general arrangement:

WIRING.

By experience it has been found best to place the wires on top of the cars. For this purpose there is a molding run along from end to end upon the roof of the car, and branch moldings extend to points over the panels between the ventilators of the car. On top of this molding is placed another, and then all of this molding is tinned over and securely soldered, so that there is no leakage into the car and the wires are fully protected. They are also free, in a great measure, from any movement by reason of oscillation or jarring, and hence the chances for abrasion of the insulation are reduced to a minimum, while at the same time they can be got at much more easily than if they were placed between the roof and the lead lining.

While it is true that the wiring of a sleeper (on account of the greater number of lights employed) is greater than that of a day coach, the average cost per car, fitted with the best wire, is about $100, including labor,

ENGINE AND DYNAMO.

A Brotherhood engine, directly connected with an Eickemeyer dynamo, both of them being upon the same cast-iron bed-plate, is placed within a lattice-work inclosure at the forward end of the baggage-car, occupying a corner between the end door and the side door. Ordinarily this space is 3½ x 5½ ft. This engine is fed by steam from the locomotive, the steam-gauge within the baggage car usually showing a pressure of 60 lbs., of which 15 is exhausted through the pipe for heating the train. The dynamo has an electromotive force of 68 volts, and has 60 ampères at 800 revolutions per minute. It should be understood that at 900 revolutions, the same machine would give 80 volts and 80 amperes. A good dynamo of this capacity will give plenty of light for 120 lamps throughout the train, and is considered an economical one, for the reason that it has margin enough to serve a longer train than usually carried, so as to meet emergencies, should they arise. The Eickemeyer dynamo, while first-class in all respects, is especially so for train service. The lattice work is open at the dynamo end, so as to admit of placing a tachometer belt upon it and arranging for the adjustment of the brushes, should it become necessary; but upon the runs I made it was not necessary to adjust the brushes, and there was no sparking at the brushes, even under full load—a most desirable point in favor of this type of machine.

Both the engine and the dynamo are fed by an automatic lubricator, which is placed against the side or end of the car, and carries sufficient oil for one or two round trips. It has small service pipes extending to the oil cups, feeding them regularly, without the attention of an engineer other than to see that they are properly started at the beginning of the run.

Against the side of the car is placed a steam gauge showing the pressure received from the engine, another steam gauge showing the pressure of steam going into the heating pipe through exhaust, an ammeter, a voltmeter, a test lamp, and a tachometer. The device for connecting the cars together is so arranged that, should they part, it will be released, as is now the case with the air-brake pipe.

STORAGE BATTERY.

Each car carries in a box, securely fastened to the bottom of the car, 32 cells of storage battery, and under the system of distribution this storage battery is partly in use at all times, furnishing, when the dynamo is running, 30 per cent. of the power given to the lamps, and when the dynamo is not running furnishing all the power. Thirty-two cells are used, for the reason that the lamps used in this system are all of a high voltage, namely 63 volts. The weight complete of the battery and its boxes is 1,300 lbs. per car.

During the day, or at other times, when the lights are not in use, the dynamo is run a number of hours, charging these storage batteries so that it is unnecessary to remove them from their location under the cars for a long time.

It is claimed that with this system the storage batteries last longer than where they are subject to removal for recharging at the end of each trip. Whether this is true or not is a question which experience alone would determine, but I am inclined to the opinion that the statement is correct.

ATTENDANCE.

This system requires an attendant, costing $90 per month and board while on the train, who is more or less experienced in electric lighting; and at terminal stations, that is to say, Chicago and New York, an expert ordinarily inspects the condition of the electric service prior to the train leaving. The arrangement of the engine is so simple that I do not see why the baggage-master should not be able to run it, after a little coaching, without any other attendant.

SYSTEM NO. 2.

The system of lighting direct from a dynamo upon a train, without the help of a storage battery, is not in use: but I do not see why it would not be a good system, for it would save the expense, both in plant and the depreciation of the storage battery. There is an objection, of course, that in case of any failure, either in connections, engine or dynamo, the lights would go out, leaving the train in darkness. This, however, could be obviated, by keeping one coach candle or one lamp in each car lit; it is necessary in any case to carry lamps or candles for emergencies. Should a derailment occur, I believe that the storage battery will be just as apt to be rendered useless by breakage as would the other mechanism.

SYSTEM NO. 3.

System No. 3 is employed by the Pennsylvania Railroad Co., the Boston & Albany, and some others. This system consists in merely placing upon each car a number of cells of storage battery (the cost of each cell ranging from $9 to $12), which are usually charged at the terminal points, the batteries then being trucked to the cars and placed therein, running one trip and then being trucked out for recharge.

The Pennsylvania Company use a small number of cells (12 to the car) and a low voltage lamp, namely, 25 volts. They claim to get 16 candle power to each lamp but I hardly think that they do this. The lamps that I have seen seem to me to be of less candle power, and they seem to use a smaller number than are necessary to properly light the car for reading. Ordinarily they carry seven lights in the body of the car at 23 volts, one in the smoking-room of 22, and one in each hallway or approach of 24 volts, making in all 10 lights to the car. With the Pennsylvania Company, at the time of my examinations, these lights were employed only in their parlor cars. The best report I could get from that company was to the effect that they really did not know what the lights cost them, but they had determined that, while the light was a little more expensive than oil, at the same time it was cheaper than gas as used by them formerly, which was placed in retorts underneath the car.

What I say here as to the cost of this system, i. e., lack of absolute knowledge, is true of all roads using it, so far as I could learn from those questioned.

The author gives the detailed cost of the equipment required for System No. 1 for the several classes of cars, exclusive of the cost of steam for the dynamo and attendance. He states that, with the plant instanced, 1 H. P. should supply about 10 lamps of 16 c. p. Hence an ordinary train might use about 10 H. P. Whether this was enough to make any appreciable draught on the locomotive boiler was a matter on which different opinions existed. The cost of equipment of several types of car in a train was found to be as follows:

	No. lamps.	*Cost of equipment.*	*Int. at 5%*	*Annual depreciation.*
Baggage	5	$1,840	$93.19	$150
Day	14	462	26.36	122
Sleeper	26	504	31.07	185

The equipment necessary for a day coach is as follows:

Articles required.	*No.*	*Cost each.*	*Total.*	*Depreciation per cent.*	*Total*	*Int. at 5%*
Battery cells	32	$9.00	$288.00	16⅔	$47.52	$14.40
Wiring	1	100.00	100.00	—	—	5.08
Lamps	14	.75	10.50	700	73.50	3.68
Lamp-sockets	14	1.10	15.40	1	.15	.77
Cut-outs	1	.45	.45	—	—	.00
Switches	1	4.00	4.00	—	—	.20
Connections	1	20.00	20.00	—	—	1.00
Shade-holders	14	.18	2.52	—	—	.13
Shades	14	.35	4.90	10	.49	.25
Elec. light arms	14	1.15	16.10	—	—	.81
			$461.87		$121.66	$26.26

The equipment in the baggage car includes one engine at $650, one dynamo at $550, and piping, steam gauge, lattice work, lubricator, tachometer, boltmeter, animeter, and safety switches costing $223, besides the battery cells, lamps, etc., for use in that especial car.

On the above basis, with an attendant at $90 per month, the author computes the total annual cost of lighting for a train of five cars at $2,057, or $5.64 per day. On this basis the cost per lamp per day (10 hours) would be $0.066. The cost for a day coach per day would be $.92 and for a sleeper per day, $1.72.

In discussing the paper, Mr. NICHOLS (C. B. & O.) said his company had made careful experiments with electric lighting on their Chicago suburban trains, but had found it too costly. He disagreed with the author as to the feasibility of having the baggage-master take charge of the engine and dynamo. It was also suggested that with System No. 2 the dynamo would take steam from the locomotive boiler at times when it could not well be spared.

Underground Temperature.

The eighteenth report of the Committee on Rate of Increase of Underground Temperature, as abstracted in *Engineering*, chiefly discusses the important observations which Mr. DUNKER, who conducted the operations at the well-known Sperenberg bore in 1876, has now, together with Messrs. KOBRICH and HUYSSEN, taken at the boring at Schladebach, near Duerrenberg, which descends to a depth of over a mile (5,830 ft.). A full report of this series of observations, undoubtedly the most valuable contribution of this kind ever made, has appeared in the *Neue Jahrbuch fuer Mineralogie*, 1889. The borehole passes through red sandstone, magnesian limestone (Zechstein), lower Permian (Rothliegendes), and coal measures to the upper Devonian beds. It was tubed to the depth of 1,240 metres, the diameters of the tubing being, for the first 584 metres, 120 millimetres; for the next 104 metres, 93 millimetres; then for 363 metres, 72 millimetres; and for the next 159 metres, 50 millimetres. From this point to the bottom the diameter gradually diminishes to about 1 in. The diamond borer was the instrument employed in sinking this well, which cost about $50,000. The boring rods weighed 20 tons, and required ten hours for hauling up.

At Sperenberg india-rubber bags had been used to prevent convection currents, which would affect the temperature indications. Such bags were unsuitable here for such a narrow bore, and hence a plugging of moist clay was employed constructed as follows: On a cylindrical iron rod, or of tough wood, are two wooden discs of a size just able to move in the bore; the lower disc is fixed, the upper movable, the part of the rod between the two being of the length of the water column which it is desired to isolate. The maximum thermometer has its bulb fastened half-way down, either beside or within the rod. The movable disc is removed to a measured distance and the space between the discs filled with clay made plastic by kneading with water. When the pole presses upon the bottom of the bore, part of the weight of the boring rods is supported on the upper disc, thus squeezing the clay against the sides of the bore and forming a water-tight plug. When it is desired to isolate a column of water at a considerable distance from the bottom, the apparatus employed consists of two portions; the above description applies to the upper portion, the lower portion is similar but inverted, and the two masses of clay cut off the water column between them.

Experiments made with a model showed that the isolation was very good and remained so after an immersion of more than ten hours. Overflow thermometers were used, generally without scales, the whole for protection being inclosed in a hermetically sealed case of stout glass with an external diameter of 15 millimetres. After being drawn up, the thermometer, together with a normal thermometer, was put into a vessel of water at a temperature a little below that which was expected; warm water was then gradually added, and the liquid kept stirred until the mercury in the overflow thermometer reached the open end. Further control observations were taken with thick mud introduced and kept between two wooden plugs. The observations extend by regular stages of 30 metres (100 ft.) down to a depth of 5,630 ft.

On plotting the temperatures as functions of depth, the curve approximates very closely to a straight line.

The evidence does not decide the question whether the curve on the whole bends upwards or downwards; that is, whether the rate of increase in temperature is accelerated or retarded with increasing depths. The whole difference amounts to 82 deg. Fahr. in 5512 ft., which is at the rate of 1 deg. Fahr. in 67.1 ft.; by applying the method of least squares, Mr. DUNKER arrives at a rate of increase of 1 deg. Fahr for 65 ft. The Committee have been anxious to interest Mr. G. WESTINGHOUSE, Jr., for such work, for which the oil and gas wells in the oil district near Pittsburg would seem to offer a good opportunity. Mr. WESTINGHOUSE has readily assented, and has entrusted three of the Committee's maximum thermometers to Mr. CUMMINS; but for some time to come no proper work can be done. Six observations have been taken at the Dilworth well at depths between 3,600 ft. and 4,295 ft., but not with sufficient precautions.

THE POTTER'S FIELD OF NEW YORK CITY is located at present on Hart's Island. Since 1869 more than 60,000 bodies have been buried there. There are no single interments; the bodies are placed in trenches, dug in regular rows, 45 ft. long, 14 ft. wide, and 10 ft. deep. Each of these pits will hold 150 bodies, which are laid three deep, in six rows of twenty-five each. In 1887, 4,158 bodies were buried on Hart's Island; the interments average about 30 per day. In the public or poor quarter of Calvary Cemetery a trench is dug 7 ft. wide, 10 or 12 ft. deep, and of indefinite length, in which the coffins are stowed tier upon tier, making a flight of steps, five or more deep, and with not enough earth to hide one from the next. It is with justice claimed that cremation is more decent, more healthful, more economical, and more respectful to the dead than this. The old Potter's Field of New York was in Washington Park, and it is alleged that its malign effect is still visible in the death rate of surrounding streets.

A Manual of Railway Field Work and Laying Out of Works.[1]

ACCORDING TO THE MOST RECENT AND APPROVED PRACTICE ON AMERICAN RAILWAYS.

BY A. M. WELLINGTON,
M.Am.Soc.C.E., M.Inst.C.E., etc.

[Copyright, 1889, by A. M. WELLINGTON.]

[*Continued from p. 400.*]

[The author will be pleased to receive typographical or other corrections, or suggestions as to form or substance, from any interested reader. All such suggestions will have full consideration.]

CHAPTER II.

THEORETICAL PRELIMINARIES.

The student should have, not simply an understanding, but a complete mastery of the contents of this chapter before proceeding further, since it is closely restricted to those theoretical preliminaries which are essential for skilful field-work.

The student is supposed to be already familiar with elementary Algebra as far as (and preferably including) the solution of equations of the second degree. If he have not this knowledge; he is recommended to at once acquire it, from——'s[2] Algebra or other good treatise.

He will especially need to have, or to at once acquire, sufficient knowledge of what may be called the language of algebra to be able to read and interpret formulæ (as for instance those given in Table I) more readily than if expressed in words. This knowledge can be very speedily acquired, and with it certain parts of this volume may be studied and used, although at great disadvantage, pending the acquirement of the further knowledge demanded.

The student is also supposed to thoroughly understand Plane Geometry, as far as to and including Book——of ——'s[2] Geometry, covering problems relating to the circle. This knowledge is indispensable, and cannot be too thoroughly or too promptly acquired.

The student is also hereafter supposed to understand the use of logarithms, although on grounds of convenience rather than of necessity. Their ready use as a tool for the saving of numerical work involves little if any knowledge of the mathematical theory underlying them, and as a labor-saving appliance, they are invaluable. In §——of Chap.——is included everything, except practice, that is necessary for their efficient practical use.

The following geometric propositions relating to the circle are those to which we shall most frequently have occasion to refer.

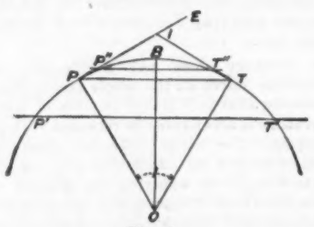


Fig. 3.

I. A tangent to a circle, as PI, Fig. 3, touches it at but one point and is perpendicular to the radius drawn through that point.

II. From any point, I, Fig. 3, without a circle, two tangents may be drawn to it, as IP, IT, which are equal, and make equal angles with the chord joining the tangent points. The exterior angle $E\,I\,T$ between these tangents is equal to the central angle I subtended by the chord connecting the tangent points.

III. If a radius be perpendicular to a chord it bisects the chord, and bisects also the angle subtended by the chord. Thus if $B\,O$, Fig. 3, be perpendicular to PT, it bisects PT, and also bisects the angle O.

IV. Two parallel chords, or a tangent and a parallel chord, intercept equal arcs. Thus if $P\,T$, $P'\,T'$ and $P''\,T''$ are parallel, the arc $P\,P' = T\,T'$ and $P\,P'' = T\,T''$.

V. The angle between a tangent and a chord is equal to half the central angle subtended by the chord. [This is true of either the obtuse or the acute angle, if the intercepted arc be taken on the same side of the chord as the acute or obtuse angle.] Thus the angles $E\,P\,A$ and $E'\,P\,A$, Fig. 4, are respectively equal to half the central angles measured by the arc cut off on either side by the chord $P\,A$, and similarly with the angles $E\,P\,B$ and $E'\,P\,B$, formed by the chord $P\,B$.

VI. Any angle having its vertex in the circumference of the circle and subtended by a chord is equal to half the central angle subtended by the chord. Thus, $A\,P\,B$, Fig. 4, $= \frac{1}{2} A\,O\,B$; and similarly, an obtuse angle $A\,P\,C$ would equal half the central angle $A\,O\,C$ *measured around the arc* $A\,B\,C$.

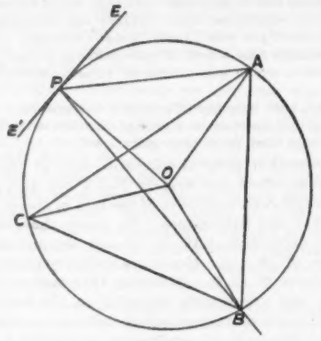


Fig. 4.

COROLLARY.—Any two angles subtended by a common chord, and having their vertex in the circumference of a circle, are equal to each other. Thus $A\,P\,B$, Fig. 4, $= A\,C\,B$.

VII. Equal chords subtend equal angles at the center of a circle, and also [by VI] at the circumference of angles having their vertex therein.

Thus, if from any point P, Fig. 5, on the circumference of a circle, a series of equal angles a be laid off, by the lines PA, PB, PC, PD, etc., these angles will subtend equal arcs, which will be subtended by equal chords, c. If this chord c be laid off in succession from P, at the same time that the successive angles a are laid off, thus fixing the points

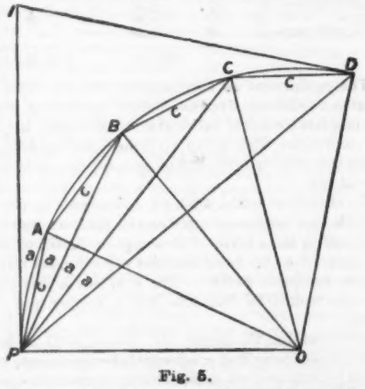


Fig. 5.

A, B, C, D, Fig. 5, then will those points all lie in the circumference of the circle, at equal distances from each other. If at any one of these points an angle $P\,D\,I$ be laid off equal to the angle $I\,P\,D$, then will the line $D\,I$ be tangent to the curve at D.

This example outlines the theory of the field-work of running in circular curves in railway location.

VIII. The exterior or deflection angle I, Fig. 6, between any two chords intersecting in the circumference of a circle is equal to half the central angle subtended by those chords.

COROLLARY.—If an angle be inscribed in a semicircle it is a right angle.

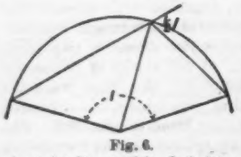


Fig. 6.

SIMILAR FIGURES are those which have all their angles equal and all their sides proportional. By considering curved lines as made up of an infinite number of straight lines, this definition applies to all figures whatsoever, whether bounded by straight lines or by curves, or in part by each.

COROLLARY 1.—All equilateral triangles, all squares, all circles, and all regular polygons are of necessity similar, as are also all segments or sectors of a circle having arcs of the same angular length.

COROLLARY 2.—Any two polygons having all their angles equal are similar to each other, and have all their sides proportional.

When two numbers, lines, or quantities are so related to each other that when the value of the one is changed that of the other must change correspondingly, they are said to be FUNCTIONS of each other. Thus the natural numbers and their logarithms, squares, cubes, square roots, etc., are functions of each other, or, as it is more commonly expressed, the latter quantities are functions of the natural numbers. Similarly, the sides, diagonals, and areas of squares, their inscribed and circumscribed circles, etc., are all functions of each other.

ANGULAR OR TRIGONOMETRIC FUNCTIONS are certain quantities or ratios used for facilitating geometric and trigonometric calculations. They express the ratio or relative value of certain lines drawn in a certain way about a given central angle. There may be an infinite number of such angular functions computed. Those most used for ordinary geometric calculations are the sine, cosine, tangent, and cotangent. From these may be deduced many others, as the secant, cosecant, versed sine, co-versed sine, external secant, co-external secant, etc., for facilitating certain special calculations. The sine is the primary function, and from it all others may be deduced, the purpose of computing additional functions being merely to facilitate calculation by saving unnecessary repetition of steps.

The angular functions are deduced as follows: Let A, Fig. 7, be an acute angle formed by the intersection of the lines $A\,B$ and $A\,C$. If from any point B on the line $A\,B$ we let fall a perpendicular $B\,C$ on the line $A\,C$, then will all possible triangles $A\,B\,C$ thus formed be *similar* to each other, and hence the ratio of $\frac{B\,C}{A\,B} = \frac{a}{c}$ will equal a constant quantity, which is called the *sine* of the angle A. If the distance $A\,B$ be made by scale $= 1$, then will the line a be by scale equal to the sine, and any other distance, $A\,B \times$ the sine of A, will equal the actual length of the line $B\,C$. Similarly, we have the following additional trigonometric functions or ratios deducible from the same diagram.

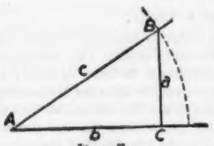


Fig. 7.

Sine, written $\sin A = \frac{a}{c} = \cos B = \frac{1}{\operatorname{cosec} A} = \tan A \cos A$, etc.

Cosine, " $\cos A = \frac{b}{c} = \sin B = \frac{1}{\sec A} = \cot A \sin A$, etc.

Tangent, " $\tan A = \frac{a}{b} = \cot B = \frac{1}{\cot A} = \frac{\sin A}{\cos A}$, etc.

Cotangent, " $\cot A = \frac{b}{a} = \tan B = \frac{1}{\tan A} = \frac{\cos A}{\sin A}$, etc.

Secant, " $\sec A = \frac{c}{b} = \operatorname{cosec} B = \frac{1}{\cos A}$, etc.

Cosecant, " $\operatorname{cosec} A = \frac{c}{a} = \sec B = \frac{1}{\sin A}$, etc.

External secant, written $\operatorname{exsec} A = \frac{c-b}{b} = \operatorname{coexsec} B = \sec A - 1$, etc.

Expressed in a manner less technically accurate, but facilitating remembrance of the precise nature of these and other angular functions, and hence the mode of definition most frequently used, we have: From A, Fig. 8, as a center, *with a radius* $= 1$, strike the arc $G\,B\,E$, draw the lines $I\,B\,C$, $D\,E$ and $G\,A$ perpendicular to $A\,E$, and the tangent $G\,F$ and line $B\,H$ parallel with $A\,E$.

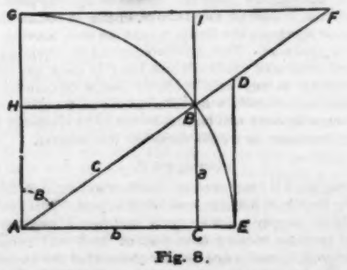


Fig. 8.

[1] Publication begun in issue of Oct. 12, 1889.

[2] The author will be obliged for suggestions as to the best treatises on Algebra, Geometry and Trigonometry to which to refer students who may not have had the advantage of good preliminary training.

Then, *if measured by the same scale with which the radius = 1 was struck:*

$BC = \sin A = \cos B$	$AD = \sec$	$A = \operatorname{cosec} B$
$AC = \cos A = \sin B$	$AF = \operatorname{cosec}$	$A = \sec B$
$DE = \tan A = \cot B$	$BD = \operatorname{exsec}$	$A = \operatorname{coexsec} B$
$GF = \cot A = \tan B$	$BF = \operatorname{coexsec}$	$A = \operatorname{exsec} B$

It is often, but incorrectly, stated that these respective lines "are" the sines or other functions, and it is convenient to mentally regard them as such if the fact be likewise kept in mind that the functions are in fact mere ratios and that the lines merely represent them to scale for a radius — 1.

The following memoriter rules assist toward the ready use of these functions for practical computations:

The sine and the cosine are always less than unity.

Two lines from which a sine or cosine is obtained are never at right angles.

Two lines by which a tangent or cotangent are obtained are always at right angles.

The radius and "cosine" form the angle. The sine is opposite.

The secant and cosecant are always more than unity and reciprocals (§ **) of the cosine and sine The tangent and cotangent are reciprocals, etc.

The use of these trigonometric functions for the solution of plane triangles is supposed to be already understood, but if not, it can be more appropriately studied in a treatise on Trigonometry. References hereafter in this volume is to ——'s Trigonometry. Only the elements of this science, which (as also algebra) is one of limitless extent, are needed for use in railway field-work. For that use the student need not have studied beyond the solution of plane triangles, but he has the greatest need of a thorough mastery, and not merely a vague understanding of so much as he has studied. Such mastery is acquired only by much practice.

(TO BE CONTINUED.)

The Resistance of Ships in Narrow Channels.

In an article on ship towage for the Corinth Canal in the *Annales des Ponts et Chaussées*, M. AMAND SAINT-YVES discusses some of the various statements that have been made on the increased resistance experienced by a vessel in passing through a channel the cross-section of which does not differ very greatly from that of the immersed midship section of the boat. Whilst the fact of an increase in the resistance has long been admitted, very different estimates have been made as to its amount. According to one of these estimates, for the same propelling power the speed of a vessel will, in a channel with a section three times that of the vessel, be only one-half the speed attained in open sea.

Another estimate makes the speed under these conditions only one-third of the sea speed, and if at the same time there is but little space between the vessel's keel and the bottom of the channel, then the speed may, it is stated, be only one-hundredth of the speed. Other estimates, quite as contradictory as the above, might be mentioned, but all go to show that the increase of resistance is very considerable. With a view to reconciling these estimates, M. SAINT-YVES remarks that the resistance is affected not only by the area of the cross-section of the channel, but also by its form as compared with that of the boat passing through it, as he states that by far the largest portion of the water displaced by the passage of a vessel escapes underneath its keel, and if this current is checked by the draught of the vessel being nearly equal to the depth of the channel, the resistance may be enormously increased.

Observations on the steamer *Ormuz*, of the Compagnie Messageries Maritimes, passing through the Suez Canal, where the section of the latter was 4.44 times the area of the immersed midship section of the steamer, showed, that whilst the sea speed of the *Ormuz* at 40 revolutions per minute was 10.52 knots, the same number of revolutions only gave a speed of 4.32 knots in the canal, or a reduction of 53.84 per cent. in the sea speed of the vessel. In order to obtain more definite information as to the Corinth Canal, which differs from that of the Suez in having nearly vertical banks, M. SAINT-YVES had constructed a model of the canal on a scale of 1-100, and also models of the more important types of vessels which are expected to pass through it.

Three models in all were made, the immersed midship section of the first being 1-2.77 times, of the second 1-3.876 times, and of the third 1-8.800 times that of the cross-section of the canal. With the first model it was found that for a sea speed of 18 knots, the canal speed would be only 54 per cent. of this, with the same expenditure of power. Two trials were made on the second model, one at a sea speed of 20 knots, the corresponding canal speed being 11.6 knots, and the other at a sea speed of 14 knots, the corresponding canal speed being only 9.38 knots. For this canal, M. SAINT-YVES advocates the employment of chain towage, as the power required to tow a vessel is much less than that which must be exerted to propel her by a screw.—*Engineering.*

THE LONDON, ESG., WATER COMPANIES have been steadily growing in the five years, 1883-87 inclusive. According to recent Parliamentary returns the number of buildings supplied by these companies in 1883 was 659,249, and in 1887, 729,162, an increase of 10.2 per cent. The revenues for 1887 are 8.2 per cent. higher than those for 1883, a greater increase than that of the share capital of the companies, 5.6 per cent. the total share capital of the 8 companies in 1887 being about $125,000,000. The first and last semi-annual dividends of the various companies for the period show a decrease of 3¼ per cent. for one company, ½ per cent. for another, the same rates for three companies, and an increase of from ½ to 1¾ per cent. for the remaining three. The lowest semi-annual dividend was 6 per cent. in 1887, a decrease of 3¼ per cent. for the period. The highest dividend was about 12 per cent., which was the rate for both 1883 and 1887.

A TUNNEL TO THE SUMMIT OF THE JUNGFRAU mountain in Switzerlan, is proposed by M. TRAUTWEILER, Chief Engineer of the Brunig Railway. A concession has been applied for. A rack railway is to be used in connection with the tunnel.

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Philadelphia & Reading.—This company has begun negotiations with the city of Harrisburg, Pa., for the right of way for the Harrisburg Terminal R. R. Co., and for the purchase of property for the approaches to its proposed bridge across the Susquehanna River. The Harrisburg Terminal Railway is projected to run from the eastern terminus of the Harrisburg & Potomac R. R. at Bowmansdale, Pa., to a point on the western bank of the Susquehanna River opposite Harrisburg, where connection will be made by the proposed bridge with the Philadelphia & Reading system.——Negotiations have been completed for the construction of the terminal road in Philadelphia. The road is to be elevated on a solid earthen foundation supported by retaining walls for the entire length, except at street crossings, where iron bridges will be built. The iron work will be done by the Reading Iron Co., and will include between 30 and 40 bridges besides the iron work for the stations.——Proposals will be called for soon for the construction of the Camden County R. R. from Mt. Ephraim to Spring Mills, N. J., 8 miles.

Indiana & Lake Michigan.—The grading on this line between South Bend, Ind., and St. Joseph, Mich., 40 miles, is well advanced and track is now being laid at the rate of three-fourths of a mile per day. It is expected that the line will be completed by Dec. 1.

Western New York & Pennsylvania.—It is announced that this company will soon commence work on the surveys for a line from Stoneboro to Oil City, Pa. The company now uses the tracks of the Lake Shore & Michigan Southern R. R. between those two points, but has, it is stated, been notified that after Jan. 1, 1890, the arrangement will cease. The plans call for a line down the Big Sandy Creek to the Allegheny River, 8 miles below Franklin, and then up the river to Franklin. From Franklin to Oil City the tracks of the New York, Lake Erie & Western R. R. will be used.

Pennsylvania, Poughkeepsie & Boston.—It is reported that the engineers of this company are now at work surveying an entirely new route for the extension from Slatington to Harrisburg, Pa. It is said that the line will run along the base of the Blue Mountain at a point north of the old South Mountain R. R., which was abandoned some time ago.

Columbus, Shawnee & Hawkins.—This company has been incorporated in Ohio, to build a connecting line of railway from a point on the Columbus & Eastern R. R., near Sattilo, Holmes County, to the Shawnee & Muskingum R. R., at Sagira, in Perry county, a distance of 10 miles. It is also stated that the company will absorb the Columbus & Eastern and the Shawnee & Muskingum railway companies. The new line will open up a rich mineral country.

Flint & Pere Marquette.—This company has purchased the 17-mile logging road located in Lake and Newaygo counties, owned by Danaher & Melendy, and will operate it as an extension of the Star Lake branch.

Grand Trunk.—The work, double tracking the line, between Montreal and Toronto is being pushed rapidly along. From Montreal to Brockville the work is completed, with the exception of a few miles. From Brockville west the work is being done in sections. Some difficulty is being had in obtaining the additional land from the farmers along the route.

Kingston & Pembroke.—An examination has been made of the country between Renfrew and Eganville, Ont., looking toward the building of an extension between those places. The line would be about 23 miles long.

Lehigh Valley.—The Buffalo & Geneva R. R. Co. has completed the surveys for the branch to Black Rock and Niagara Falls and grounds for new car shops at Buffalo. It is expected that work will commence on the main line from Buffalo to Geneva, N. Y., early next spring.—— John Shields, of Flemington, N. J., has the contract for building the New York extension from Roselle to Lyon's Farm, N. J., 4 miles, and the 2-mile section to Newark has been let to Broadhead & Hickley.

Indianapolis & Vincennes.—Grading has been finished on the Gosport branch of this road and tracklaying is now in progress. The road is to be completed by Jan. 1, 1890.

Ohio & Mississippi River.—The annual report of this company for the year ending June 30, 1889, shows the following results of operations as compared with the previous year:

	1888	1889
Gross earnings	$3,977,559.81	$3,955,165.36
Operating expenses	2,733,417.69	2,935,300.84
	$1,244,142.12	$2,935,366.52

The rate per ton mile for freight was 0.814 ct. in 1889 against 0.763 ct. in 1888.

Somerset.—Tracklaying on the extension from Embden to Bingham, Me., 10 miles, has reached Carratunk Falls, and it is expected that the entire line will be completed by Nov. 1.

New York, Ontario & Western.—The following officers have been elected by the stockholders of the Ontario, Carbondale & Scranton R. R.: E. B. STURGIS, President; J. FLEMING, Secretary and Treasurer; C. R. PITCHER, Assistant Treasurer. The Board of Directors consists of W. H. RICHMOND, J. JERMYN, O. S. JOHNSON, ED. DOLPH, C. D. SIMPSON, DAN'L SCURRY, C. F. SPENCER, F. P. FOWLER, W. W. PATERSON, JOHN KERR, J. BUSTAN, and E. CLARKSON.

Pennsylvania.—This company has abandoned the charter of the Reading & Lebanon R. R. Co., which was incorporated sometime ago to build a railway from Reading to Lebanon, Pa.

Chesapeake & Ohio.—This company will do a large amount of work in improving its line. All the few remaining wooden bridges will be taken out, and iron structures of the heaviest build put in their place. All the trestles will be filled in, additional ballast will be put on the entire road from end to end, and the sidings will be so extended as to accommodate the long freight trains which are now being run. Heavy steel rails will be laid in many places where the travel is unusually heavy, and dozens of new switches will be put in, everything tending to prepare the road for the fast, heavy running which will begin as soon as the improvements, shall have been completed.

Projects and Surveys.

Troy & New England.—Organized in New York to build a line of railway from Troy to Averill Park, N. Y. The directors of the company are as follows; WALTER P. WARREN, CHAS. W. TILLINGHAST, WM. A. THOMPSON, ED. MURPHY, Jr., H. T. CUTLER, HENRY H. DARLING, LEWIS R. GURLEY, ED. F. MURRAY, CHAS. E. PATTERSON, WM. KEMP, JAS. K. AVERILL, ANDREW J. SMART, and EDGAR LYND.

Catskill Narrow Gauge.—A press dispatch states that surveys will soon be made for a narrow-gauge railway from West Hurley, N. Y., to the Overlook Mountain House. It is said that the ascent of the Overlook Mountain will be overcome by a cable. The project also includes an extension to the head of the Platterkill Clow and then to Hunter and Tannersville.

Kennebec Central.—The contract for building this Maine road, which is to run from Augusta to Togus, Me., has been let to Michael O'Neil, of Portland. Work has already commenced.

Castine & Bangor.—The town of Castine, Me., has raised $10,000 in addition to the $12,400 previously raised in aid of this road. The road is projected to run from Castine to Bangor, Me., a distance of 37.7 miles. JAMES ADAMS, of Bangor, Me., is President.

New York, Bridgeport & Eastern.—Incorporated in Connecticut to succeed to the right of way, surveys, etc., of the New York & Connecticut Air Line R. R. Co., which was chartered to build a line of railway from the New York State Line to New Haven, Conn. The surveys for the road were completed some time ago, and plans and profiles made.

Mount Moosilauk.—Surveys have been commenced for this road, which is to run from a point on the Con-

cord & Montreal R. R. to the top of Mt. Moosilauk, N. H., a distance of 9½ miles. About 1¼ mile of this distance will be rack and cog-wheel track.

Grand Rapids & Lake Michigan.—This company has been organized in Michigan to build a railway from Grand Rapids to Holland, Mich., a distance of about 26 miles.

SOUTHERN.—Existing Roads.

South Brunswick Terminal.—This road has been completed from South Brunswick to Waynesville, Ga., 16 miles. It is stated that work will soon commence on the extension from Waynesville to Cordele, Ga., 160 miles, and the road be pushed rapidly through to completion.

East Tennessee, Virginia & Georgia.—Work is being pushed on the line from Montevallo to Birmingham, 35 miles. About 1,000 men and 750 teams are at work between Blockton and Montevallo.

Monongahela River.—This road has been completed from Fairmount to Shinniston, W. Va., and work is now being pushed from Shinniston to Clarksburg. At Clarksburg the road will connect with the Clarksburg & Western R. R., controlled in the same interest, which is being changed to broad gauge and extended to Braxton C. H. The road runs through a section rich in coal and iron.

Wadley & Mt. Vernon.—Tracklaying has been commenced on this road, which is being built from Wadley to Mt. Vernon, Ga.

Nashville, Chattanooga & St. Louis.—It is announced that this road is considering extending its Jasper branch from Dunlap, Tenn., up the Sequatchie Valley.

Alabama Midland.—A press report states that the contract for building a 26-mile branch south from Luverne, Ala., has been let to Brown & Co., of Pensacola, Fla. It is said that the company is aiming for a Gulf terminus at Pensacola.

Louisville & Nashville.—A report is in circulation that this company is considering an extension from Stevenson, Ala., via Fort Payne, to Atlanta, Ga.

Atlantic & North Carolina.—The stockholders of this company will hold a special meeting Nov. 21, to consider the question of extending the road.

Projects and Surveys.

Linville Improvement Co.—This company has commenced surveys for a line of railway to run from Cranberry, N. C., to Linville, a distance of 12 miles. The road will run through a rich mineral and timber country. There will be two mountain ranges to cross.

Watauga Valley.—Chartered in Tennessee to build a railway from a point near Johnson City, Tenn., via Elizabethtown to a point on the North Carolina State line where the Watauga River crosses the same. The charter also empowers the company to build branches and extensions to mines and other railways within the counties of Carter, Johnson, Union, and Washington.

Atlanta, Ashville & Baltimore.—The contract for building this road has been let to the New England R. R. Supply & Development Co., 27 Doone St., Boston, Mass. The road is projected to run from Atlanta, Ga., to Roanoke, Va. N. ATKINSON, of Ashville, N. C., is President.

Laney & Piedmont.—A project is on foot to build a railway from Laney to Piedmont, Ala., a distance of 20 miles. J. C. LANEY, of Laney, Ala., is interested.

Georgia.—The following bills have passed the Georgia State Legislature: incorporating the Hawkinsville & Florida Southern R. R. Co., the Kansas City, Chattanooga & Port Royal R. R. Co. Bills incorporating the Union Point & Elberton Short Line, the Alabama Coal & Iron, and the Fairmount Valley railway companies have passed the Senate.

Mobile, Jackson & Kansas City.—Work is in progress securing the right of way for this Mississippi road. The line will run from Mobile, Ala., to Jackson, Miss., 175 miles. T. W. NICOL, of Mobile, is Chief Engineer.

Cape Fear & Cincinnati.—We have received the following information concerning this enterprise from GEO. B. MORTON, Neal Building, Baltimore, Md., Vice-President and Chief Engineer:

The road is to run from Wilmington, N. C., via Southport in a northwesterly direction to Greenville, S. C., with several branches. The route is through a timber country affording a very favorable line; maximum grade 35 ft. per mile and maximum curve 3°. The line is being built by an independent company and will be operated in connection with a line of steamships from Wilmington to Baltimore, Philadelphia, and New York. The principal business of the road will be in cotton, rice, lumber, iron, coal, farm produce, fish, oysters, and naval stores. About 50 miles of the right of way has been secured together with valuable water front at Southport, N. C. Local aid to the amount of several hundred thousand dollars has been promised by the towns along the route and an offer for $1,000,000 of bonds has been made. The contracts for construction will be let in about 30 days. It is expected that tracklaying will commence in about 4 months and the first 50 miles will be completed within 6 months. The company was incorporated Aug. 27, 1889. FRANK BROWN, is President.

West Virginia & Pennsylvania.—C. E. GALLAGHER, Chief Engineer, is reported as saying that construction will commence on this road soon and the division from Rowlesburg, W. Va., to the Pennsylvania State line is to be completed by June, 1890. Surveys have been completed for this portion of the line and the engineers are at work for a pass across the mountains. The northern terminus of the road has not been decided upon yet.

Georgia, Southern & Florida.—J. S. McTighe & Co., of Memphis, Tenn., have advertised for bids for grading 65 miles of the extension from Macon, Ga., to Birmingham, Ala.

NORTHWEST.—Existing Roads.

Winona & Southwestern.—Joseph Walker & Sons, of New York, the financial agents of this company, state that a majority of the security holders of the Green Bay, Winona & St. Paul R. R. Co. have assented to the plan of extending the road to Omaha, Neb. The road is now completed from Winona to Bear Creek Station, Minn., 22 miles, and construction is in progress on 10 miles more.

Chicago, Burlington & Quincy.—It is stated that this company will advance the money necessary to build a belt-line from South Omaha to Bellevue, Neb., partly encircling the city of Omaha. The object of the road is to develop a large amount of suburban property available for residences, which is now laying idle.

Canadian Pacific.—Egan Bros. have completed their grading contract on the Brandon-Souris branch of this road.

Duluth, South Shore & Atlantic.—General Manager FITCH, of this company, is quoted as saying that there is no probability that the company will build a branch from Iron River to Superior, Wis., 30 miles. Another report states that the surveys and profiles have been made and that the line will be built early next spring.

Union Pacific.—A circular has been issued by this company giving the following information as to the new operating arrangement. All the lines in Nebraska, Kansas, and Colorado, except the St. Joseph & Grand Island, Kansas Central, Leavenworth, Topeka & Southwestern and Leavenworth branch, will be operated as one division, to be known as the Mountain division. The lines excepted above will be the Missouri River division; and all west of Huntington, including the lines and ships of the Oregon Railway & Navigation Co. and other leased lines, will be known as the Pacific division. EDWARD DICKINSON will be General Manager of the Missouri River division; G. M. CUMMINGS General Manager of the Mountain division, and C. J. SMITH of the Pacific division. The office of General Manager of the Union Pacific is abolished. T. L. KIMBALL, third Vice-President, will be stationed at Omaha.

Pacific Short Line.—It is announced that no more grading will be done on this road this season. The portion already graded is to be completed and tracklaying will, it is stated, be commenced in a few days. As soon as completed the division from Sioux City, Ia., to Plainview, Neb., will be put in operation.

Great Northwest Central.—Arrangements are being made for getting out the ties and bridge timber for this road during the coming winter, and it is stated that construction will commence next spring and 300 miles of the road will be built next season.

Northern Pacific.—A rumor is in circulation that this company will apply to the next session of the Canadian Parliament for a charter and land grant for a road to run by the most direct route to the Atlantic seaboard.

Chicago & Northwestern.—A traffic arrangement has been entered into between this company and the Union Pacific Railway Co. The agreement, which runs for 10 years, provides for joint tariffs and trains, the settlement of disputes, division of earnings from through traffic, proportion of equipment rates under competition, and that no competitor shall have advantages over the parties of the agreement, which goes into effect Nov. 1. The alliance will work to the advantage of both parties, giving the Chicago & Northwestern a line to the Pacific coast and the Union Pacific an entrance into Chicago, and virtually giving the VANDERBILTS a through line from ocean to ocean.

Chicago & Alton.—It is announced that this road has been purchased by the VANDERBILTS and other allied interests, and will hereafter be operated as a portion of the Vanderbilt system of railways.

Projects and Surveys.

Sabine Pass & Duluth.—A press dispatch from Duluth, Minn., states that at a meeting of the Chamber of Commerce, recently held, a communication from L. T. HUNT, of Springfield, Mo., was presented, asking their coöperation in the formation of a railway company by this name to build a railway from Sabine Pass, on the Gulf of Mexico, to Duluth, Minn.

Arden & Duck Mountain.—This company has been organized to build a railway from Arden, Man., in a generaliv northerly direction to the Saskatchewan River, with a branch to Lake Manitoba.

Midland Pacific.—It is reported that the contract for building 140 miles of this road has been let. The road is projected to run from Pierre, Dak., to Puget Sound.

Albert Colonisation.—An application will be made at the coming session of the Canadian Parliament for a charter incorporating this company to build a railway from Cassilsee, on the Canadian Pacific R. R., westerly, via Grassy Island and Crow's Nest Pass to the Pacific coast.

SOUTHWEST.—Existing Roads.

Missouri, Kansas & Texas.—The reorganization committee of this company has submitted the following plan for the reorganization of the company. The holders of the present consolidated mortgage 7 per cent. bonds will receive fifty-year 5 per cent. bonds, principal and interest payable in gold, with a priority of interest for five years over all other bonds. These bonds will be secured by a first lien on all property now securing the consolidated sevens. Holders of general consolidated mortgage 6 and 5 per cent. bonds will receive fifty-year 4 per cent. bonds, principal and interest payable in gold. The sixes will be exchanged dollar for dollar, and the fives at the rate of 80 cts. on the dollar. The common stock will be changed for new common stock.

Kansas City, Watkins & Gulf.—Grading on this Louisiana road is making rapid progress. Large re-enforcements of laborers have been ordered, and eight new camps have been established from the fourteenth to the twenty-eighth mile on the road.

San Antonio & Aransas Pass.—Dispatches from Waco, Tex., state that this company is making preparations to bridge the Brazos River at that place and build north toward the Red River. It is also stated that negotiations are in progress for the lease of the Texas Central branch of the Houston & Texas Central R. R.

Projects and Surveys.

Fort Worth & Albuquerque.—It is stated that CHAS. C. BLACK, of New York, President, has let the contract for building 100 miles of this road from Fort Worth, Tex., west beyond Jacksonboro. It is announced that the company's bonds were placed in Scotland.

Pittsburg & Topeka.—A company has been chartered in Kansas to build a line of railway from Topeka to Pittsburg.

ROCKY MT. AND PACIFIC.—Existing Roads.

Union Pacific.—A press dispatch from Cheyenne, Wyo., states that work will soon commence on the extensions to the west and north. The extension of Cheyenne & Northern, it is stated, will be commenced first, and then the line into the Yellowstone National Park will be built. It is not probable, however, that work will be commenced upon these lines for some time.

California.—According to reports received by the State Railroad Commission, the following is the status of railway construction in California for the present year. Up to date 90 miles of new track have been laid, and there is yet approaching completion the Southern Pacific short cut line across Sutter County, from Knight's Landing to Yuba City, 20 miles, and also the Nevada & California line in Lassen County. Since last January the San Diego, Cuyamaca & Eastern Road, 22 miles long, has been built from San Diego to Lakeside. The San Francisco & North Pacific has pushed its lines to Ukiah, 14 miles. The Southern Pacific Company has extended its line from Newman, on the west side of the San Joaquin River, to a point known as the terminus, 21 miles from Newman. The other work has been done in patches, here and there. The total estimated amount of tracklaying for the year is 125 miles. For the next year much more construction work is predicted, especially by the Southern Pacific Company.

Northern Pacific.—Work on the Cœur d'Alene branch is making fair progress. It is expected that the grading will be completed within the next 30 days. A large shipment of rails has just arrived and tracklaying is in progress.

Montana Central.—Chief Engineer E. H. BECKLER, of Helena, Mont., is organizing a corps of engineers to begin the survey of the proposed extension to the Pacific coast. It is stated that the surveys will commence at once and will be carried on through the winter, and that the construction of the line will commence early next spring.

Ellensburg & Northeastern.—Steel rails and ties sufficient for completing 10 miles of this Washington road have been ordered and will be put in place at once. Work is making good progress on the remainder of the line. The road is to run from Ellensburg to Port Euston, 40 miles. JOHN A. SHONDY, of Ellensburg, Wash., is President.

Oregon Pacific.—The grading is now completed to a point 24 miles beyond Gatesville, Ore., including the contract of Antonelle & Doe. The contract for building 15 miles more of the line beyond the present contract has been let to Orman, Crook & Co., of Pueblo, Col., and they have already commenced work.

Wyoming, Salt Lake & California.—About $100,000 of the $250,000 of bonds asked of Salt Lake City by this company have been subscribed.

Ogden & Hot Springs.—About 20 teams and a force of men are now at work on this road which is to run from Ogden, Utah, to Hot Springs, a distance of 10 miles. Col. A. H. SWAN, of Ogden, is interested.

Projects and Surveys.

Puget Sound & Great Eastern.—This company has been chartered in Washington to build lines of railway, beginning at Seattle and running in an easterly direction through the Cascade Mountains via Spokane Falls and by a main or branch line to an outlet on and connection with the Great Lakes and Atlantic Ocean,

together with such branch or connecting lateral lines, running northerly or southerly from main lines, as the corporation may deem necessary,and to obtain subsidies, grants, right of way, to acquire property, issue certificates and do all other things necessary thereto.

The Board of Trustees for the first six months is as follows: WILLIAM VAN FLEET, of New Jersey; WILLIAM J. BROADWELL, of New York: EDWARD VERNON, of New York; JOHN ARTHUR, of Seattle; HENRY M. CROKER, of Seattle; WILLIAM COLLIER, of Washington; J. LUTTRELL MURPHY, of Seattle.

Peninsular.—This railway company has been incorporated in Washington by JOHN MAYO PALMER, EDWARD F. BOGART, CHAS. E. TAYLOR and others.

Montana & Canada.—It is stated that the bonds of this company have been placed and the contracts for building the line let. Work will begin early next spring and the road pushed rapidly to completion. The road is projected to run from Lethbridge, Mont., to Fort Benton, a distance of 185 miles, with a branch to the Montana Central R. R., about 40 miles long.

FOREIGN.

Yucatan.—The Secretary of Public Works has signed a contract with JOSÉ E. MALDONADO for the building of a railroad and corresponding telegraph line from Cancel to the port of Progreso, Yucatan. The concession is for 99 years, and the work of construction will have to be commenced in one year from the signing of the contract, and the road must be finished in five years. The concession is granted without a money subsidy, and within four months $4,000 in public debt bonds must be deposited with the National Bank of the City of Mexico, Mex.

China.—Work is to commence soon on the railway from Hankow to Pekin, China. The road will pass through three provinces, Chihli, Honau, and Hupst. A loan of $5,250,000 is now being negotiated to build the first division from a point 5 miles south of Pekin to Cheng-Ting. There will be a large bridge across the Yellow River.

South America.—It is now expected that the transcontinental line from Buenos Ayres to Valparaiso, a distance of 871 miles, will be completed during 1892. About 722 miles of the line is already finished and of the remaining 149 miles about one-third is finished. The crossing of the Andes Mountains will be made at the Cumbre Pass by a 3 mile tunnel 10,450 ft. above the sea. On some portions of the line the grade is 422 ft. to the mile requiring the use of a rack rail; the Abt rack rail system will be used.¶

RAPID TRANSIT.

Electric Railways.—***Troy, N. Y.***—It is proposed to extend the Troy and Albany electric road to the cemeteries.

Oswego, N. Y.—An electric railway is to be built by MAITLAND E. GRAVES, who has a franchise for electric lighting.

Nashville, Tenn.—The Nashville & Edgefield St. Ry. Co. has awarded the contract for the plant for its Sprague electric road to the Gaynor Electric Co., of Louisville, Ky. There will be 10 cars ——The South Nashville St. Ry. Co. has adopted the Sprague system; there will be 10 cars.

Chicago, Ill.—The Dearborn Elevated & Surface Electric Ry. Co. has been incorporated by DAVID T. CORBIN, W. L. SESSIONS, and H. H. C. MILLER. Capital stock, $12,000,000.

St. Louis, Mo.—The Missouri Ry. Co. proposes to build an electric line to Tower Grove.——The Lindell Ave. St. Ry. extension will be on the Sprague system, with 2 cars.

Hutchinson, Kan.—The street railway company proposes to adopt an electric system.

Eureka Springs, Ark.—An electric railway is to be built. For particulars address DR CHAS. E. DAVIS.

Dallas, Tex.—The Dallas Rapid Transit Co. has awarded the contract for electric equipment to the Sprague Electric Motor Co.

Portland, Ore.—The Thomson-Houston Electric Co., has been granted a franchise for an electric railway to East Portland.

The Thomson-Houston Electric Co., of Boston, has completed roads at the following places: Central Ry., Peoria, Ill., 10 miles, 15 cars; Citizens' Electric St. Ry., Decatur, Ill., 5 miles, 10 cars; Metropolitan St. Ry., Kansas City, Mo., 5.4 miles, 4 cars; Omaha, (Neb.) Motor Ry., 5 miles, 4 cars; Quincy (Mass.) St. Ry., 5 miles, 4 cars; Richmond (Ind.) St. Ry., 4 miles, 6 cars.

Contracts have also been closed for the following roads: Albany (N. Y.) City Ry., 14 miles, 22 cars; City Electric Ry., Nashville, Tenn., 5.6 miles, 6 cars; Kearney (Neb.) St. Ry., 8 miles, 2 cars; Macon (Ga.,) City & Suburban Ry. 4 miles, 4 cars; Metropolitan St. Ry., 3 miles, 2 cars; St. Paul, (Minn.) City Ry., 31 miles, 20 cars; St. Paul & Minneapolis Ry., 20 miles, 20 cars; Union Depot Ry., St. Louis, Mo., 10 miles, 30 cars. Also contracts for a line at San José, Cal., and for the College Park Belt Line Ry. Co. at Sherman, Tex.

Street Railways.—***Manchester, N. H.***—The street railway will be changed to standard gauge.

Boston, Mass.—The West End St. Ry. Co. has been petitioned to extend its line to Roslindale.

New York, N. Y.—The 28th & 29th Sts. Ry. Co. is building its lines, having agreed to use the grooved rail approved by Commissioner GILROY.

Baltimore, Md.—The Baltimore City Passenger Ry. Co. is investigating the Judson system of traction.

Washington, D. C.—The Judson Pneumatic St. Ry. Co., of New York, has made a proposition to the Metropolitan Co. to put in its system on the 7th St. branch.

Joplin, Mo.—A franchise has been granted for a street railway which will extend to Webb City, Mo., and Galena, Kan.

Salem, Ore.—The Salem St. Ry. Co. has let the contract for the construction of its line.

Seattle, Wash.—The contract for the trestle of the dummy line to South Seattle has been awarded by Mr. J. M. THOMPSON to THOMAS A. JONES. The line will cost about $50,000.

Port Townsend, Wash.—The Port Townsend Construction & St. Ry. Co. has been incorporated by ROBERT C. HILL, HENRY LANDES and R. S. MILLER. Capital stock, $100,000.

Cable Railways.—***Providence, R. I.***—The Cable Tramway Co. has awarded the contract for its building at Olneyville to N. B. Horton.

Seattle, Wash.—The Front St. Cable Ry. Co. has commenced construction. A. JACKSON is Superintendent in charge of the work.

San Francisco, Cal.—The Sutter St. Cable Ry. Co. is reconstructing some of its lines, at a cost of $14,000 per block.

Elevated Railways.—***Chicago, Ill.***—The West Chicago Rapid Transit Co. has awarded the contract for the iron work of its road, which will be similar to the New York elevated roads, to the Pencoyd Iron Works. Secretary, E. NELSON BLAKE, General Manager, A. M. WRIGHT. The road will cost about $500,000 per mile. The company's capital stock is $6,000,000.

Kansas City, Mo.—The Rapid Transit Ry. Co. has been incorporated by DAVID REEVES and A. BONZANO, of Phœnixville, Pa.; S. F. SCOTT, of Kansas City; LOUIS ADLER, of New York; H. E. ROBINSON, of Gardiner, Me., and others. Capital stock, $7,000,000 The road is to connect Kansas City, Mo., and Kansas City, Kan.

Kansas City, Kan.—The United States Elevated Ry., Car & Car Wheel Construction Co. has been incorporated at Topeka, by WM. THOMPSON, WM. H. BIGGER and LEWIS C. TRUE, of Kansas City, Kan.; WAITMAN M. MORGAN and others of Kansas City, Mo. Capital stock, $250,000. The company intends to build elevated railways and equipment for the same, including car wheels, under the W. M. Morgan patents.

Elevated Railway.—***Chicago, Ill.***—The Philadelphia Bridge works, of Philadelphia, Pa., have obtained the contract for building 4½ miles of the Lake Street Elevated Railway; double-track. They also expect to receive further contracts for three or four miles of branches, etc.

HIGHWAYS.

California.—The county calls for the pretty penny of $279,000 this year for roads. And yet the road between the two principal cities of the county, Los Angeles and Pasadena, is a disgracefully poor highway.— *Pasadena Star.*

Indiana.—A special election was held in Franklin and Walnut townships, Montgomery County, recently, to vote on buying short pieces of toll roads in said townships. In Franklin township there were 4 miles of road, valued at $500, but the proposition to purchase this was voted down by 56 majority. In Walnut township there was 0.66 miles, valued at $200, and the majority against buying this was 42, out of a vote of 154. These two roads are the ends of roads leading from Crawfordsville through Union township, where there are no toll roads now.

Georgia.—The Grand Jury, at Carrollton, Ga., had every road commissioner in the county prosecuted for neglect of duty. The caution will probably be heeded and marked improvements made very soon.

Colorado.—The County Commissioners have closed a contract with the citizens of Rico to complete the Scotch Creek Road, the commissioners to appropriate $3,000 and the citizens the balance. The road will be built at once to connect with the road now being built by Messrs. Stafford & Co. for La Plata County.

Wisconsin.—The Milwaukee *Sentinel* aptly suggests that at the coming farmers' institutes to be held in the several counties, the question of roads be largely discussed. There is nothing which would prove more beneficial. Eighty per cent. of the overseers know as much about making good roads as the average Democratic editor does about the kingdom of Heaven—and no more! —*Chippewa Falls Herald.*

Pennsylvania.—Delaware County, though wealthy and thickly populated, has never had good roads, and a movement is now being made to place the highways in good condition. The daily and weekly papers have joined in the crusade against the rough and stony thoroughfares, while the Court has censured supervisors for negligence in the discharge of their duties. War has been made upon the Darby Turnpike by citizens residing between Chester and the Philadelphia County line, for the purpose of having the company's charter annulled. The pike is in even worse condition than the dirt roads, and when the road is out of the company's hands a telford pike will be constructed.——The company owning the Carbondale and Providence Turnpike, 9 miles long, has had suit brought against it for neglect in the care of its road.

CONTRACTING.

School House.—***Quincy, Mass.***—The following proposals have been received by JOHN P. PRICHARD, Commissioner of Public Works, for constructing the Willard school house: Isaac H. Cushing, $69,990; Reed & Seelye, $75,000; Howard Coon & Co., $91,000; John Y. Mainland, $94,860; B. F. Denning, $99,500; P. P. Kelly, $105,973; F. H. Tarbox, $107,238; Meade, Mason & Co., $109,700.

Creosoting.—The following proposals for creosoting 180,000 ft. of yellow pine have been received by JAMES FULTON, Paymaster General, U. S. N., Navy Department, Washington, D. C.: Lehigh Valley Creosoting Works, Perth Amboy, N. J., $20 per 1,000 ft.; Eppinger & Russell, New York, $23; S. E. Haskin, New York, $13 (informal).

Granite.—The following proposals for furnishing and delivering the cut granite for court yard walls of the Congressional Library building were opened Oct. 24 by BERNARD R. GREEN, Superintendent and Engineer, 145 E. Capitol St., Washington, D. C.: Southern Granite Co., Lithonia, Ga., $163,790.10; Guilford & Walterville Granite Co., Baltimore, Md., $175,437; Mount Waldo Granite Co., Maine, $179,000; Booth Bros. & Hurricane Isle Granite Co., New York, $193,000; Cape Ann Granite Co., Boston, Mass., $194,970 and $235,000; Hallowell Granite Works, Hallowell, Me., $210,528; Charles Runnels, Lowell, Mass., $222,412.82; Westham Granite Co., Richmond, Va., $223,339. The contract was awarded to the Guilford & Walterville Granite Co., theirs being the lowest bid for a granite conforming to all the requirements of the specifications.

Asphalt Paving.—The following were the prices of bids received by the Commissioner of Public Works, New York City, for asphalt paving over the present stone block pavement on Park Ave. between 34th and 40th Sts.: Barber Asphalt Co., $4 per sq. yd. for pavement, 50 cts. per sq. ft. for bridge stone, $44,100. E. J. McKeever, $4.30, 75 cts., $48,450. Taylor Asphalt Co., $4.75, 55 cts., $52,360. The contract was awarded to the Barber Asphalt Co., as noted last week. For asphalt paving with concrete foundation on Madison Ave., between 32d and 33d Sts.: Sicilian Asphalt Co., $4.45 per sq. yd. for pavement, 75 cts. per sq. ft. for bridge stone, 15 cts. per sq. ft. for old bridge stone, $126,100. Taylor Asphalt Co., $4.75, 55 cts., 10 cts., $133,025; Barber Asphalt Co., $5.15, 50 cts., 10 cts., $145,200. E. J. McKeever (informal).

Cross Walks.—The following proposals have been received by the Board of Public Works, Denver, Col.: N. K. Miller, $8,203.18; Moore & Clough, $8,307.12; T. M. Carrigan, $9,719.95; J. E. Riley & Co., Omaha, Neb., $10,108.01; J. B. Hindry, $10,540.79; Jamison & Co., $10,577.94; G. L. Kimball & Co., $11,159.70; J. M. Eisenhart, $12,804. The engineer's estimate was $15,989.60.

Street Work.—***Jersey City.***—The following bids have been received for repairing Montgomery St., and the contract has been awarded to P. J. Condon, at about $24,500.

Bidders.	Earth ex., 1707 cu. yds.	Earth fillinr, 500 cu. yds.	Sand filling, 1,200 cu. yds.	Granite pavings, 7260 sq. yds.	New curb, 20-in., 400 ft.	New bridge 668 sq. ft.	Repaving 1,000 sq. yds.	Reset curb, 3,160 lin. ft.	New flag.	Relaid flag.	Reset rec. basin	Reset manhole heads, 12.	Cribbing 139 lin. ft.
	cts.	cts.	$	$	cts.	cts.	cts.	cts.	cts.	cts.	$	$	cts.
John M. Shannon..... ...	30	60	1.50	2.97	60	65	60	10	60	00	10.00	1.00	60
P. J. Condon ?.....	20	70	1.55	2.70	50	90	05	08	30	08	1.00	1.00	08

Street Work.—***Oakland, Cal.***—The following proposals have been received by the Trustees. Bituminous rock paving on 8th St.: Santa Cruz Rock Paving Co., 29¼ cts. per sq. ft. for grading, concreting and laying bituminous rock, 35 cts. per sq. ft. for basalt blocks laid in gutters; for relaying block, 5 cts.; granite curbs, $1.18 per lin. ft.; removing all gutter stones, 1 ct.; removing stone crosswalks, 1½ cts.; filling cavities, 30 cts. per cu. yd. James H. Swift: grading, concreting and laying bituminous rock, 28 cts.; basalt blocks, 34 cts.; relaying blocks, 6 cts.; granite curbing, $1.15 cts.; removing old gutter stones, 2 cts.; iron

culverts, $3.70; removing crosswalks, 2½ cts.; filling cavities, 35 cts. For macadamizing, the Alameda Contracting Co. bid 7 cts. and the Oakland Paving Co. 7¼ cts. per sq. ft.

Tiling.—The following proposals for tiling the floors of the corridors of the new Court House at Boston, Mass., have been received by the commissioners: J. N. Jaros & Co., New York, tiles, 63 cts., 48 cts., 41 cts., and 37 cts. per sq. ft.: P. H. Butler & Co., Boston, Italian marble, 41 cts. per sq. ft.: Georgia marble, 46 cts. per sq. ft.; Murdock Parlor Grate Co., Boston, tiles, $38,824.17, $26,030.95, $35,220.66; Bowker, Terry & Co., Boston, marble, $42,941.70, $35,059.95, $33,145, $32,648.66; Charles E. Hall & Co., Boston, marble, $32,737.94, $31,805.80, $27,252.42, $38,019.38, $31,843.54; Quincy Granite Co., granite, $76,730; Fisk, Coleman & Co., Boston, tiles, $21,113; $27,572, $29,724; Batterson & Co., New York, marble, $43,259; Davidson Marble Co., New York, marble, $31,752, $30,942, $26,171.

Paving Blocks.—The Portland Paving & Macadamizing Co., of Portland, Ore., has contracts from J. M. Thomson for basalt blocks for paving 5 miles of cable railway in Portland and 7 miles in Seattle, Wash.

Stone.—The contracts to furnish the stone for the new addition of the Massachussetts State House has been awarded to the Bodwell Granite Co., of Hallowell, Me., at about $78,000.

Concrete Paving.—The contract for concrete paving in the new post-office building at Baltimore, Md., has been awarded to I. S. Filbert at $15,000.

Sewer Material.—The following proposals have been received by the City Commissioner, Baltimore, Md. For materials for the Jenkins run and Carter alley sewer: Cement: John Bullock & Son, Portland, $2.90 per bbl.; Rosendale, $1.30; Round Top, $1.12. Sand: Patrick Reddington, 70 cts. per cu. yd.; Patrick Keelty, 70 cts.; M. F. Leonard, 69 cts. Brick: Daniel Donnelly, $7.50 per 1,000 for machine made; James R. Busey & Son, hand-made, $8.95, machine made, $8.45; G. W. Robinson & Co., hand made, $7.70; Maryland Brick Co., machine made, $7. Stone: John G. Schwind, $2 per cu. yd.; John Harris, $1.59; John Curley, $1.48. Sewer blocks: Wm. F. Weiler, $1.45 per 1,000; McGlenahan & Bros., $108; Guilford & Walterville Granite Co., $145.50.——For the Pulaski St. sewer: Sand, Morgan & Bressman, 85 cts. per cu. yd. Stone: David Leonard, $1.74 per cu. yd.; John G. Schwind, $1.53; John Harris, $1.88. Cement: S. M. Hamilton, for Cumberland, $1.40 per bbl.; Portland, $2 John Bullock & Son, Round Top, $1.17 per bag; Rosendale, $1.30; Portland, $2.90 per bbl. Charles C. McColgan & Co., Rosendale, $1.24 per bbl.; 90 cts. per bag. Brick: Fred Rice, hand-made, $8.95 per 1,000. Pitcher & Creager, $9 for hand-made, $8.55 for machine-made. Young O. Wilson Brick Co., hand-made, $9; machine-made, $8.60. James R. Busey, hand-made, $8.95; machine-made, $8.50. Sewer blocks, Guilford & Walterville Granite Co., $1.60 per 1,000; Wm. F. Weiler, $1.59.

Jail.—The contract for the jail and sheriff's residence at Martinsville, Ind., has been awarded by the County Commissioners to Thos. J. Turner, of Martinsville, at $21,000.

Paving.—The following proposals for basalt block paving on the seawall have been received by the Harbor Commissioners of San Francisco, Cal.: F. H. Pitman, 22½ cts. for paving, $1.08 for stone curbs, 18 cts. for wooden curbs. T. Coyne & Co., 27 cts., $1.10, 25 cts. J. W. McDonald, 23¼ cts., $1.09, 29 cts. D. Harney, 24½ cts., $1.10, 20 cts. J. Kelso & Co., 27½ cts., $1.30, 15 and 25 cts. San Francisco Contracting Co., 23⅝ cts., $1.09, 19¾ cts. The contract was awarded to F. H. Pitman at about $22,389.

Dredging.—The following proposals for dredging in the James River, Va., at Kingsland reach, were opened Oct. 26, by Col. Wm. P. Craighill, U. S. Engineer Office, Richmond, Va.: Chester T. Caler, Norfolk, Va., 18 cts. per cu. yd.; Morris & Cummings Dredging Co., New York City, 20 cts.

PROPOSALS OPEN.

Roads and Bridges.—Two county roads; one 12½ miles long, with a bridge of 150 ft. span; the other 3-miles long with a bridge 160 ft. long. Maurice Newman, County Clerk, Mariposa, Cal.

Sewers.—Brick sewers, 36 and 39-in.; tile sewers, 9, 10, 12, 15 and 18-in. Geo. E. Mann, City Engineer, Buffalo, N. Y. Nov. 4.

Bridge.—Wooden arch bridge, with approaches, on the Mendota road. Thos. A. Prendergast, City Clerk, St. Paul, Minn. Nov. 5.

Railway Clearing and Ties.—San Antonio & Aransas Pass Ry., extension from Houston to the Trinity River. Proposals for clearing 100 ft. at so much per acre. Also the delivery of 100,000 heron ties 8 ft. by 7 ins. by 8 ins. of white oak or cypress, at a price per tie, stating time required for complete delivery; 50,000 near the crossing of the San Jacinto River, and 50,000 near the crossing of the Trinity River. J. P. Nelson, Chief of Construction, San Antonio & Aransas Pass Ry., 418 Soledad St., San Antonio, Tex. Nov. 5.

Street Work.—Improving Goodman St.; grading, flagging, curbing, macadamizing and building culverts. Thos. G. Smith, President, Board of Public Affairs, Cincinnati, O. Nov. 7.

Paving.—Laying pavement along crib bulkhead from W. 76th to W. 80th St., North River. About 810 cu. yds. of earth excavation, 26,057 ft. B. M. of yellow pine timber, 1,362 lbs. of ⅞ x 22-in. and ¾ x 12-in. square dock spikes, 410 cu. yds. sand or gravel, 2,945 sq. yds. paving (blocks to be furnished by the Department). The Docks Commissioners, Pier A, North River, New York City. Nov. 8.

Pumping Station.—Engine house, boiler house, and smoke stack at the Alum Creek pumping station. A. H. McAlpine, Superintendent and Engineer of Water-Works, Columbus, O. Nov. 9.

Railway.—Grading 65 miles of the Georgia Southern & Florida R. R. extension, between Macon, Ga., and Birmingham, Ala.; about 2,000,000 cu. yds. of earth and rock. J. S. McTighe & Co., Memphis, Tenn. Nov. 11.

Street Work.—Improving North Crescent St., Avondale. W. Ellwood Wynne, Clerk of Avondale, Swinton Building, Cincinnati, O. Nov. 11.

Bonds.—Corporation debentures for $18,000. L. T. Desaulniers, Secretary-Treasurer, Three Rivers Corporation, Three Rivers, Que., Canada. Nov. 11.

Asphalt Paving.—Asphalt pavement on concrete foundation. The Commissioner of Public Works, 31 Chambers St., New York City. Nov. 11.

Pipe and Specials.—Cast-iron water pipe, branch pipes and special castings. The Commissioner of Public Works, 31 Chambers St., New York City. Nov. 11.

Switch and Pipe.—Railway switch water, pipe and fire hydrants. Major Clifton Comly, U. S. A., Columbia, Tenn. Nov. 11.

Bridge.—Superstructure of bridge on Burr St. across Fauquier St. Plans and specifications on file in the office of the City Engineer. Thos. A. Prendergast, City Clerk, St. Paul, Minn. Nov. 12.

Hoisting Engines.—Combined stationary engines and appurtenances at Shaft No. 25 on Section No. 12 of the new Croton aqueduct. James C. Duane, President, Aqueduct Commissioners, 280 Broadway, New York City. Nov. 13.

Water Works.—Aqueduct extension. Section 1, 48-in. and 36-in. pipe lines from new storage reservoir to new pumping station and present conduit; Section 2, storage reservoir; Section 3, 48-in. cast-iron pipe and castings for force main from storage reservoir to Millburn pumping station; Section 4, Millburn pumping station; Sections 6, 7, and 8, supply ponds, pump well and conduits; John P. Adams, Commissioner of City Works, Municipal Building, Brooklyn, N. Y. Nov. 18.

Electric Lighting.—Plant for supplying 300 arc lights of 1,000 c. p. or its equivalent of incandescent lights. Frank E. Rebarer, City Clerk, Savannah, Ga. Nov. 25.

Street Work.—Grading, curbing, bowldering, and constructing culverts and retaining walls. Thomas G. Smith, President, Board of Public Affairs, Cincinnati, O. Nov. 26.

Bonds.—City improvement bonds. H. E. Bryan, City Clerk, Columbus, O. Nov. 27.

MANUFACTURING AND TECHNICAL.

Market Prices.—*Rails.*—New York and the East: $32; the New York Central has placed order for 10,000 tons and the Lake Erie & Western for 5,000 tons. Old rails, $24.50 to $25. Pittsburg: $33 to $34. Old rails, $27 for iron, and $22.50 for steel. Chicago: $35; Old rails, $25.50 to $26 for iron, $19.50 for steel.

Track Material.—New York; spikes, $2.15 to $2.25 delivered; angle bars, 2 to 2.15 cts. Pittsburg; spikes 2.10 cts., 30 days; splice bars, 2 cts.; track bolts, 3 cts. with square and 3.10 cts., with hexagon nuts. Chicago; spike, 2.20 to 2.25 cts.; steel splice bars, 2.10 cts.; iron splice bars, 2 cts.; track bolts, 2.75 cts., with square and 2.85 cts., with hexagon nuts.

Miscellaneous.—Sheet iron, Chicago: 3.15 to 3.20 cts., at mill; 3.40 to 3.50 in small quantities. Barb wire Chicago: 3.15 to 3.25 cts. painted, 60 cts. per 100 lbs. extra for galvanized; St. Louis, 3.15 in small lots to 3.25 cts. in carload lots for painted, 3.75 to 3.85 cts. for galvanized.

Nails.—Chicago: $2.25 for cut steel, $2.65 for wire, at mill. Pittsburg: $2.25 for cut. St. Louis, $2.90 to $3 for wire.

Cable Plant.—The Walker Mfg. Co., of Cleveland, O. has contracts for the cable-driving plants for the new cable roads being built at Portland, Ore., and Seattle, Wash., by the Pacific Cable Construction Co., of San Francisco.

The Massapequa Improvement Co. has been incorporated by Thomas H. Brush, Wm. A. Brush, Thomas B. Carman, and Thomas C. Snedeker, of Brooklyn, N. Y., and E. S. Carman, of River Edge, N. J. Capital stock, $500,000. The company proposes to build wharves, docks and piers.

The Mt. Desert Construction Co. has been incorporated to carry out improvements and erect buildings at Mt. Desert, Me. President, Geo. M. Wheeler, Washington, D. C.; Treasurer, Elvin J. Torrey, Bar Harbor, Me.

Wind Engines.—The Northwestern Wind Engine Co. has been incorporated at Minneapolis, Minn., by Charles P. Silloway, Charles C. Elfelt, and Henry F. Silloway, to construct wind engines and pumps, and to contract for water-works and sewers.

The West Georgia Construction Co. has been incorporated at Columbus, Ga., to build the Georgia & Tennessee Ry., and other railways. President, Gunby Jordan, General Manager of the Georgia Midland Ry., Columbus.

Rail Braces.—The Illinois Rail Brace & Chair Co. has been organized at Chicago by James T. Anderson, T. J. Smith, and Chas. A. Webb. Capital stock, $100,000.

The Sabine Construction Co. has been incorporated by Robert M. Walmsley and Percy Roberts, of New Orleans, La., and T. H. Allen, James M. Peters, R. A. Parker, and Harry Allen, of Memphis, Tenn. Capital stock, $300,000. The company will build railways and other public works.

Steam Road Rollers.—The Harrisburg Car Works, of Harrisburg, Pa., have built a 15-ton steam road roller for New Albany, Ind., and another, weighing 14 tons, for use in Druid Hill Park, Baltimore. The main roller in front is 45 ins. wide, and the rear wheels 18 ins. wide; the latter can be fitted with spurs for tearing up old streets. The roller driving gear can be thrown out and the engine used to run a stone crusher.

Car Heating and Ventilation.—The McLeod Car Heating & Ventilating Co. has been organized at Boston, Mass. President, John S. McLeod; Vice-President, Geo. R. Brine; Secretary and Treasurer, Henry Hartley; General Manager, Col. Thos. R. Sharp; Superintendent of Equipment, Thos. Meehan. Capital stock, $1,000,000. It is said that the system is to be tried on the Baltimore & Ohio and Staten Island Rapid Transit roads. The invention provides for the heating and ventilation of the cars by a circulation of air forced through a coil of pipes in the firebox of the locomotive by pumps operated by steam from the boiler. The waste hot air is thus utilized with no more expenditure than that of first cost to heat and ventilate the entire train. Refrigeration in summer is provided for.

Car Wheels.—A company has purchased land at Norristown, Pa., for a site for buildings for the manufacture of rolled steel car wheels.

The Centropolis Car & Machine Works, of Centropolis, Kan., are turning out castings and iron posts for buildings in Kansas City. The works have some large contracts for cable and electric cars. Mr. Emil Ehmbom, from the car works at Pullman, Ill., has taken charge of the car building department.

Locomotives.—The Portland Co., of Portland, Me., is building a passenger engine for the Windsor & Annapolis.

The Baldwin Locomotive Works, of Philadelphia, Pa., have sent out several standard gauge engines to the Rio Grande Western.

The Dickson Mfg. Co., of Scranton, Pa., has built 10 mogul freight engines and 3 switch engines for the Georgia Central.

The Jeffersonville, Madison & Indianapolis has received from Altoona a large passenger engine, which is to haul the fast express trains. It weighs 100,000 lbs. and has 68-in. driving wheels.

The Toledo, St. Louis & Kansas City road has placed an order for building 15 locomotives.

Cars.—Barney & Smith, of Dayton, O., have a contract for vestibule cars for four complete trains for the Cleveland, Cincinnati, Chicago & St. Louis. Also 2 dining cars for the same road.

The Jackson & Woodin Mfg. Co., of Berwick, Pa., has a contract for 250 cars for the Delaware & Hudson.

The Indianapolis Car Works, of Indianapolis, Ind., have an order for 900 coal cars for the Pittsburg & Western, and for 250 coal cars for the Lake Shore & Michigan Southern.

The Columbus, Hocking Valley & Toledo Ry. Co. is receiving bids for 500 new box cars for carrying furniture, carriages, etc. They will be 35 ft. long, 8 ft. high, and may be fitted with automatic couplers.

Palace Cars.—The Wason Car Co., of Springfield, Mass. is building a car on the new plan of the Harris Palatial Car Co., of Boston. It is 66 ft. long, on six-wheel trucks, and will cost $30,000. The sleeping berths pack away below the floors instead of up in the ceiling, as in the Pullman and Wagner cars. It is expected to run this car on the Connecticut River road in January next.

The Westinghouse Machine Co. sold during October, 30 Junior engines, representing 935 H. P., 16 standard engines, 645 H. P., and 30 compound engines, 2,510 H. P.; a total of 76 engines aggregating 4,090 H. P.

The Pond Engineering Co. has shipped a 125 H. P. steam plant for an electric railway in Laredo, Tex., and a 70 H. P. outfit for the State Capitol at Austin, Tex. The Kansas City office has an order from the North east Electric Ry. Co. for two Armington & Sims engines of 150 and 70 H. P. with the necessary pumps, heater, etc., to make the plant complete.

Frogs.—The Indianapolis Frog & Crossing Co. has just got out, for the Louisville, New Albany & Chicago, a line of complicated crossings for the L., N. A. & C. to make its connections with the Belt road. To make this connection the L., N. A. & C. has to cross three tracks.

The Fowler Steel Car Wheel Co. will shortly be in

a position to place their make of wheel on the market. The blanks are cast from steel, made under the Bookwalter and Roberts process, and then rolled in an ingenious machine to the required dimensions. The claim is made that this rolling process gives the rim and flange the necessary hardness, while the balance of the wheel retains its ductility and softness, and consequently its elasticity. Among the advantages expected from this new type of wheel are—that by being in one piece it will be safer than made-up wheels, and as the wearing surface is thicker, it will give 50 per cent. more mileage than other types of wheel, because it can be turned off more frequently before being finally condemned. The market price of this wheel will be very reasonable, it is said.

New Cruisers.—Secretary TRACY has awarded the contracts for building two of the 2,000 ton cruisers, proposals for which were opened Oct. 26, to the Columbian Iron Works & Dry Dock Co., of Baltimore, for $1,255,000. The contract for the third one will be awarded either to Harrison Loring, of Boston, or N. F. Palmer & Co., of New York, each of whom bid $674,000.

Railway Equipment.—The New York Equipment Co. has a contract from the Montgomery, Tuskaloosa & Memphis Ry. Co. for the equipment of the road. There will be 7 eight-wheel locomotives valued at $8,500 each; 8 ten-wheel locomotives, valued at $9,000 each; 8 first-class passenger cars, valued at $4,500 each; 6 second-class passenger cars, valued at $4,000 each; 5 baggage, mail and express cars, valued at $3,100 each; 5 cabooses, valued at $900 each; 200 flat cars, valued at $325 each; 150 box cars, valued at $440 each; 100 gondolas, valued at $500 each. The total value of the equipment contracted for is $381,500. By the provisions of the contract the locomotives are to be built at Dunkirk, N. Y., the passenger equipment at Hegewisch, Ill., and the freight cars at either Anniston or Decatur, Ala. The contract requires that all the equipments shall be first-class and furnished with latest improvements.

Railway and Other Plant Wanted.—About 3,000 ft. of 40-lb. steel rails for granite quarries at Lithonia. VENABLE BROS., Atlanta, Ga.

Rails and cars for a tramway. Roseland Lumber Co., Roseland, La.

Standard gauge dummy engine. JAMES C. WHITE, General Manager, Fountain Head Ry. Co., Knoxville, Tenn.

Dump cars wanted. C. M. H., Atlanta *Constitution* office, Atlanta, Ga.

A second-hand oil or gas engine. Stone & Huesman, Room 504, Mermod & Jaccard Building, St. Louis, Mo.

About 40,000 ft. B. M. of pine lumber, delivered. W. H. TYNDALL, architect, Galveston, Tex.

About 300 M. first-class yellow pine. Geo. S. May & Co., Atlanta, Ga.

The Pond Engineering Co. has furnished the American Electric Light Co. of Kansas City with a 50 H. P. Armington & Sims engine, and the Empire Cordage Co., of Champaign, Ill., with a 15 H. P. Gardner vertical engine for driving the isolated Edison plant. They will furnish and erect two 150 H. P. boilers complete, with Pond Engineering Co's. setting, for the St. Louis Smelting & Refining Works.

The Employers' Liability Assurance Corporation, of Boston, reports that Mr. J. L. BUTLER met with an accident on a cable car in Philadelphia shortly after he had invested 15 cts. in accident tickets from one of the company's automatic ticket boxes. This investment resulted in a payment of $750.

Medal Awarded.—The Ingersoll-Sergeant Rock Drill Co. has been awarded the first prize, a gold medal, for its exhibit at the Paris Exposition.

BRIDGES AND CANALS.

Bridge Notes.—*Burlington, Vt.*—The cost of the Grand Isle bridge is estimated by Charles H. Clark, of St. Albans, bridge designer for the Central Vermont R. R., at $40,954. Grand Isle has voted $13,000; South Hero, $2,000; Alburgh, $2,000, and $1,000 from other places, leaving $2,954 to be raised by subscription, the State appropriation being $20,000.

Boston, Mass.—The Street Commissioners state that the cost of a pile bridge 60 ft. wide across Fort Point Channel, to connect Oliver St. with Northern Ave., would be $220,000, and of an iron bridge $350,000.

Memphis, Tenn.—The Kansas City & Memphis Ry. & Bridge Co. has issued $3,000,000 in bonds for its bridge across the Mississippi.

Pineville, Ky. — The County Court has made an appropriation of $10,000 for a new bridge across the Cumberland River. For particulars address A. L. MONROE.

Cincinnati, O.—The County Commissioners have awarded the contract for the superstructure of the Coleram Avenue Bridge to the Milwaukee Bridge & Iron Co., of Milwaukee, Wis., at $15,944. —The Cincinnati, Indianapolis, St. Louis & Chicago Ry. will build a bridge over the deep cut at North Bend.

Kansas City, Kan.—A committee consisting of President HILIKER, GEO. W. MARTIN, and GEO. WATSON has been appointed to assist Col. W. P. VAN AITKEN toward securing from the Secretary of the Interior the approval of his plans for the construction of the proposed bridge across the Missouri River opposite the city. The secretary held that VAN AITKEN has failed to begin work on the bridge within the time specified in the franchise, and has refused to approve the plans. The failure on the part of VAN AITKEN to begin work on the bridge is due mainly to the delay in securing the reclamation franchise at the hands of the council.

Kansas City, Mo.—The Kansas City Switch & Frog Co. has a contract for iron work for the Winner Bridge. —The cost of the pontoon bridge at Randolph Point is estimated at $35,000.

St. Joseph, Mo.—The Kansas Switch & Frog Co. has the contract for iron work for two bridges across the Missouri River.

Portland, Ore.—The contract for the 12th St. bridge has been awarded to Thomas Davison.

Tacoma, Wash.—It is proposed to build a wooden bridge at 10th St., 110 ft. above high water, without a draw, at a cost of $110,000.

Quebec, Canada.—Mr. BENDER, who went to England to raise money for the Quebec bridge over the St. Lawrence, is said to have succeeded in forming a syndicate of English capitalists to provide the money.

Macon, Ga.—The contract for wooden bridges has been awarded to G. W. Killen, at $1,075. A large number of iron bridge builders were prepared to make bids, but the bridges are to be cheap wooden structures, on iron piles. W. G. SMITH is County Clerk.

Lake Huron Canal.—It is reported that Col. O. M. POE, U. S. Engineers, has consented to be Consulting Engineer for the proposed canal improvement, connecting Lake Huron with Black River, at Port Huron. The present project only contemplates a canal for the purpose of flushing out Black River. Hon. E. C. CARLETON, when in Congress, was planning for a government canal sufficiently large and deep to allow of lake craft passing through, and thereby avoiding the hard pull at the rapids.

Bridge Abutments.—The following proposals for building abutments for the Manton village bridge have been received by the city engineer of Providence, R. I.: A. & J. Fournier, $9 per cu. yd. for 370 yds. of masonry in cement, $4.50 per cu. yd. for 106 yds. of dry masonry, $3 per cu. yd. for 50 yds. of old stone, $3,707 total. B. A. Woodbury, $8.75, $6, $1.65, $3,791. J. P. Tank, $8.75, $7.75 $1, $4,009. F. B. Horton, $9.50, $7.50, $1.50, $4,129. John Ganey, $12.62, $9.88, $2, $5,616.68. The contract was awarded to A. & J. Fournier.

ELECTRICAL.

Electric Lighting. — *Rockland, Me.* — Propositions for furnishing a plant of 300 lights have been made by three companies. The Eastern Co., of New York, for a 1,200 c. p. light, $60 per year for a midnight, and $69 for an all night light. The Westinghouse Co. for a 1,200 c. p. light, $72 for a midnight, and $108 for an all night light. The Rockland Electric Light & Power Co., $80 for a midnight, and $115 for an all night light, 30 lights, and $75 for each additional midnight above 30.

Swanton, Vt.—It is proposed to put in an electric light plant, but opinion is divided between the advantages of the city owning its plant or granting a franchise to a company.

East Albany, N. Y.—The East Albany Gas Light Co. has awarded the contract for constructing the new electric system to Mr. Seeley, of Troy.

Jamestown, N. Y.—The proposition to issue bonds for an electric light plant to be owned by the city has been defeated by public vote, a local company having made an offer to supply electric light service at $6 per lamp per month.

Oswego, N. Y.—The contract with M. R. Graves, mentioned last week, requires the lights to be of 2,000 c. p. and suspended by wires over the middle of the street, about 25 ft. from the surface.

McKeesport, Pa.—The City Council has made a contract with the McKeesport Light Co. for incandescent lighting, with lights of 16 c. p. at $13 each per annum.

Salisbury, Md.—The Salisbury Electric Light Co. has been incorporated by PRESTON LEE, of Wilmington, Del., A. A. GILLES, and E. S. TOADVINE. Capital stock $30,000.

Camden, Ark.—A local company has been organized and will put in a Thomson-Houston plant. President, S. O. SEVIER; Secretary, J. B. FRIEDHEIM.

La Grande, Ore.—The La Grande Edison Electric Light Co. has been granted a 10 years franchise. The plant will have 800 lights and will cost $15,000.

Seattle, Wash.—The only proposal received for electric lighting for one year was from the Seattle Electric Light Co.: 15 and 30 c. p. incandescent lights, $2.25 and $3.50 per month; 2,000 c. p. arc lights, $14 per month. The company to maintain the plant and keep it in condition. C. W. PERRIS is City Clerk.

Savannah, Ga.—Proposals will be received by FRANK E. REBARER, City Clerk, until Nov. 25 for furnishing plant to supply electricity for 300 arc lamps of 1,000 c. p., or its equivalent of incandescent lights. W. J. WINN, City Surveyor, can give particulars.

SEWERAGE AND MUNICIPAL.

Street Work.—*Boston, Mass.*—The Council has appropriated $100,000 for the paving department in addition to the sum already appropriated, for the purpose of placing the department upon a permanent basis.

Montgomery, Ala.—City Engineer R. M. BOLLING has recommended the construction of concrete sidewalks with a bottom course 2½ ins. thick of Portland cement and gravel 1 to 5, and a top course 1¼ ins. thick of Portland cement and fine sand 1 to 6.

San Francisco, Cal.—A resolution has been passed providing that pavements on accepted streets shall be of basalt blocks or bituminous rock, both on concrete foundation.

Bonds.—Bids for $275,000 granite paving bonds have been received by the City Comptroller, Cincinnati, O.: Simon & Huseman for the $125,000 bid $128,515.63; for the $150,000 they bid $154,593.75.

German National Bank, Seasongood & Mayer, and the Western German Bank bid for the $125,000, $129,400; for the $150,000 they bid $155,507; accrued interest in each case.

Public Works.—The Survey Bureau, Philadelphia, Pa., has applied for an appropriation of $1,176,670 for the year 1890, to be divided as follows: District surveyors' salaries and expenses under the fee system, $64,705; examination, ventilation, and reconstruction of old sewers, $40,000; for main sewers, $300,000; Aramingo Canal system, $100,000; new bridges, $50,000; branch sewers and inlets, $200,000; intercepting sewer and connections, $50,000, and Walnut Street bridge, $300,000.

Sewerage.—*Fairfield, Me.*—The surveys for the system of sewerage provided for at the last spring election are being made by Mr. I. E. GETCHELL, of Vassalboro.

Salem, Mass.—The Council has appropriated $11,400 for sewers.

South Tonawanda, N. Y.—It has been voted to spend $120,000 for a sewerage system.

Lansingburg, N. Y.—The plans prepared by the Village Trustees for trunk sewers in eight streets have been examined by Mr. CHARLES C. BROWN, engineer of the State Board of Health. The plans must be approved by the Board, and work will probably not be started before spring.

Wellsville, N. Y.— A sewerage commission has been appointed to investigate the question of establishing a system of sewers. The Board of Health has sent the engineer, Mr. CHAS. C. BROWN, to look into the matter.

Brooklyn, N. Y.—The Commissioner of City Works will advertise very shortly for bids for the new sewers in the 26th Ward. The Board of Health has had to consider the plan for the disposal of the sewage. The Legislature will be petitioned for authority to issue $500,000 more for extensions.

Denver, Col.—The contract for sewers in the North Denver sewer district has been awarded to J. E. Riley & Co.

Fort Russell, Wyo.—The contract for the water and sewer system has been awarded to Keefe & McGarvey, of Cheyenne, at $37,512.60.

Salt Lake City, Utah.—Three bids for the sewerage pump, all from local firms, were received by the City Recorder.

Salem, Ore.—Sewer contracts have been awarded to A. Mason and Smith & Robertson.

Santa Cruz, Cal.—An engine and boiler are to be purchased for the sewage pumping plant.

Old Town, Me.—A sewerage system is proposed. Messrs. LAUGHTON and CLERGUE, of Bangor, are interested.

WATER-WORKS.

NEW ENGLAND.

Old Town, Me.—C. W. ROBBINS, Town Clerk, sends us the following:

Pipe for the new works has been distributed. Fifty hydrants will be set. The supply will be taken from the Penobscot River. Laughton & Clergue, the contractors, have been granted a 20 years' franchise, the town agreeing to pay a hydrant rental of $2,500 per annum. The population is 5,000.

Orono, Me.—The town is negotiating with Laughton & Clergue for the construction of a system of works.

Cape Elizabeth, Me.—It is reported that investigations are being made for a source of water supply. Address H. W. FOSTER.

Seal Harbor, Me.—It is reported that A. G. Murphy, of Philadelphia, is to put in a system of works. The supply to be taken from Echo Lake, 2½ miles from the town. [The Seal Harbor Water Co. was organized in 1888 to build a gravity system of works, taking the supply from Jordan Pond, 2 miles from, and 230 ft. above, the town. SAMUEL F. BARR was President. Estimated cost, $20,000. J. M. CAMPBELL was interested in the prospect.—ED.]

Boscawen and Penacook, N. H.—The officers of the company are: President, J. C. PEARSON; Vice-Pres't, C. H. AMSDEN; Clerk, J. K. GAGE, of Concord.

Whitingham, Vt.—Pipes, for the new works are being laid from Tobey Brook to Readsboro.

Westfield, Mass.—A small amount of new mains are being laid under the supervision of Superintendent DIEHL.

Somerville, Mass.—The new high-service pumping-station is nearly completed. The engine room is 32 by

31 ft., and the boiler room 40 by 31 ft. Estimated cost, $8,000.

North Adams, Mass.—A new main is being laid across the fair-ground. It is expected that the connections will be made with the reservoir this fall.

MIDDLE.

Brooklyn, N. Y.—Bids will be received until Nov. 18, by Commissioner of City Works ADAMS, for building the new aqueduct from Rockville Center 10½ miles east, constructing a storage reservoir, and erecting a pumping station. The contracts will let in several sections. City Engineer ROBERT VAN BUREN will have charge of the work.

West Troy, N. Y.—Fairview Home is to be supplied with water from the company's stand-pipe. A force pump will be necessary to raise water to the tank at the home. Pipe-laying will be begun soon.

Tuxedo Park, N. Y.—The Tuxedo Water Co. has been formed to erect works and supply the town of Monroe. Capital stock, $100,000. The trustees are: PETER LORRILARD, PIERRE LORRILARD, Jr., WM. KENT, T. BURNETT BALDWIN, JOSIAH PATTERSON, ALFRED SETON, Jr., and GEO. D. FINLAY.

Tarrytown, N. Y.—SAMUEL B. LEACH, Engineer of the new works, informs us that the system will soon be put in operation.

Palmyra, N. Y.—The pumping machinery for the new works will be furnished by the Buffalo Steam Pump Co., of Buffalo, N. Y.

Hamburg, N. Y.—The Buffalo (N. Y.) Steam Pump Co. has been awarded the contract for furnishing the pumping machinery for the new works.

Altamont (formerly Knowersville), *N. Y.*—The residents are talking over a scheme to procure a water supply. It is proposed to take the supply from Thomson's Lake, about 6 miles distance. The water of the lake is of good quality, and of volume sufficient to furnish an adequate supply. Estimated cost, $20,000.

Perry, N. Y.—H. A. COLE has sent us the following:

The town has been contemplating the erection of works for several years, but no decisive steps have yet been taken, and the prospects are none will be taken soon.

Medina, N. Y.—The Board of Trustees has revoked its decision to grant a franchise to an Elmira firm. Village Attorney PITTS has now invited Engineer J. NELSON TUBBS, of Rochester, to look over the land south of the village with a view of locating the plant.

Nutley, N. J.—The new works are nearly completed. The contractors were Ferris & Halladay, of Jersey City.

Camden, N. J.—It is proposed to levy a special tax to secure funds for obtaining a pure water supply. Chief Engineer MINES has recently submitted a report in which he advocates general improvement of the system, and the employment of an expert to ascertain if a sufficient supply cannot be obtained by the driven well process.

Newark, N. J.—Work has been begun by the East Jersey Water Co. on the large storage reservoir to be located on the upper Pequannock River, near Oak Ridge. It will be about 4 miles long, and 2 miles wide, and formed by building a dam across the river valley, about 3,000 ft. long, 15 ft. wide at the base, and 100 ft. high. The company has purchased the Macopin Lake and Dunker Pond water rights at $44,000 and $20,000 respectively, and will utilize them in connection with their plant.

Montrose, Pa.—W. L. COX, City Secretary, informs us that nothing has been done further than granting a franchise to W. H. JESSUPS, Jr., of Scranton.

Braddock, Pa.—A new water system is being put in at the Edgar Thomson steel works. The main at the steel works will connect with the furnace main. Superintendent, CHARLES M. SCHWAB.

Philadelphia, Pa.—The Germantown Water Improvement Committee have presented a petition to the City Council asking that Mount Airy Reservoir be enlarged so as to serve as a subsiding reservoir, and that to this be added a filtering plant.

SOUTHERN.

Green Cove Springs, Fla.—It is reported that parties are negotiating for the purchase of the works. [Works were projected in 1888, but at the time of the issue of THE MANUAL OF AMERICAN WATER-WORKS FOR 1888, the scheme was classed as "indefinite." It is therefore more probable that steps are being taken to build than to sell.—Ed.]

Vicksburg, Miss.—The company will soon begin laying additional mains, which will increase the mileage in the city to 15 miles. W. O. Gorman has been awarded the contract for constructing a tunnel from the pumphouse to the river. It is to be completed by Dec. 30.

Yazoo City, Miss.—Address the Mayor for information regarding the projected works.

Oxford, Miss.—Works are projected. Address W. A. WEST.

Columbia, Tenn.—U. S. Arsenal.—Bids will be received until Nov. 11 for furnishing pipe and hydrants, by Major CLIFTON COMLY, U. S. A.

NORTH CENTRAL.

Hillsboro, O.—We have received the following information from JOHN N. NICOL:

Works will doubtless be erected in the near future, but nothing definite has yet been done. Propositions have been received from the Commonwealth Construction Co., of Philadelphia, and two other parties. Water will be pumped from driven wells to a stand-pipe. Estimated cost, $70,000. S. P. SCOTT is Chairman of the Water Committee. Population, 4,000.

Columbus, O.—Bids will be received on Nov. 9, by Superintendent A. H. MCALPINE, for constructing an engine-house, boiler-house and chimney at the Alum Creek pumping-station.

Upper Sandusky, O.—The Upper Sandusky Water-Works Co. has elected the following officers: President, Dr. R. N. MCCONNELL; Vice-President, JOEL W. GIBSON; Secretary, C. D. HARE; Treasurer, E. A. GORDON; Superintendent, W. S. COON.

Crawfordsville, Ind.—Prof. J. M. COULTER has analyzed water from several of the wells now furnishing the supply, and pronounced it unfit for use. Steps will probably soon be taken to secure pure water.

Crystal Springs, Mich.—The contract for furnishing the pumping machinery for the new works has been awarded to the Buffalo (N. Y.) Steam Pump Co.

Grosse Point, Mich.—The Grosse Point Water Co. has been incorporated. Capital stock, $30,000.

Peoria, Ill.—The site has been decided upon for the new reservoir.

Murphysboro, Ill.—W. K. MURPHY is making arrangements to build works.

Austin, Ill.—A small amount of additional mains have been ordered laid.

Whitewater, Wis.—N. W. Harris & Co., of Chicago, Ill., are now offering $36,500 of the Whitewater Water Co.'s 20 year 6 per cent. first mortgage bonds for sale.

Eau Claire, Wis.—The company will hereafter supply the city from Wheaton Springs, 4 miles north of the city, instead of from the Chippewa River.

Beaver Dam, Wis.—It is proposed to construct a canal, 2½ miles long, to connect Beaver Dam and Lost Lakes, to obtain an additional supply.

Madison, Wis.—A 60,000-gall. iron tank, is to be constructed. It will be 12½ ft. in diameter by 64 ft. high, and be placed on a brick foundation, 68 ft. high. The estimated cost is $7,000.

NORTHWESTERN.

Sibley, Ia.—Bids are being received for sinking a 5 in. well by the Sibley Water-Works Co.

Guthrie Center, Ia.—The following information is from C. L. FERREL:

Works will probably be constructed in the spring. Estimated cost, $8,000. It is proposed to pump the supply from wells to a tank. Further details may be obtained from CHARLES ASHTON. Population, 1,000.

Minneapolis, Minn.—The Northwestern Wind Engine Co. has filed articles of incorporation at St. Paul. One of its objects is to construct water-works. The incorporators are: CHARLES P. SILLOWAY, CHARLES C. ELFELT and HENRY F. SILLOWAY.

St. Paul, Minn.—The pumping engines in the new pumping station at Baldwin Lake will have a daily capacity of about 10,000,000 galls. Water is pumped through a main about 1,000 ft. long, to the top of the ridge, and there conveyed by flumes and a canal to Charles Lake; thence to Pleasant and Vadnais lakes, a portion of it supplying the gravity system, and the pumping station at McCarron's lake forcing part of it to the reservoir at that point. The work will probably be completed in December. Estimated cost, $25,000.

Paola, Kan.—E. W. ROBINSON, formerly Manager, has been appointed Receiver of the works, and authorized to spend $11,000 in repairing and extending the system. The receiver was appointed on application of LEW WALLACE Jr., of New York, City Attorney, for the American Loan & Trust Co., which holds a $75,000 mortgage and brought suit for foreclosure.

Belleville, Kan.—A complete system of works is to be constructed. Eight-inch mains are now being laid in the principal streets.

Randolph, Neb.—A contract has been let for constructing works.

Scribner, Neb.—A system of works is projected. Address the City Clerk.

Seward, Neb.—J. C. MULFINGER, Mayor, has sent us the following.

Contracts were awarded as follows on Sept. 17: Pipe: Shickle, Harrison & Howard Iron Works, of St. Louis; stand-pipe, Brownell & Co., of Omaha; sinking wells and furnishing deep well pumps, A. F. Cook, of St. Louis; Large fire pump, Pond Engineering Co., of St. Louis. Engineer A. T. RICHARDSON, of Lincoln. Population, 2,400.

SOUTHWESTERN.

Warrensburg, Mo.—The subject of constructing works is being discussed.

PACIFIC.

Aberdeen, Wash.—GEO. D. ALLY, Secretary, sends us the following:

The capital stock of the Aberdeen Water Co. is to be increased from $10,000 to $25,000. Water is to be pumped from a creek to a tank. President, C. B. WEATHERWAX; Secretary, GEO. D. ALLY. Population, 1,800.

Sprague, Wash.—The new works will be completed about Dec. 1. John Corkish, of Portland, Ore., is the contractor.

Whatcom, Wash.—Collins & Powell inform us that the new works are to be completed Jan. 20. P. B. CORNWALL is Superintendent of Construction for the Bellingham Bay Water Co. The supply is pumped from Whatcom Lake direct to mains.

East Portland, Ore.—The company's reservoir on 13th and H Streets has been declared unsafe by the Fire and Water Committee. Steps will probably be taken to repair it.

McMinnville, Ore.—The following information is from J. J. SPENCER:

Work will be begun as soon as contracts can be let. Estimated cost, $20,000; to be procured by bonding the city. Water will be pumped from Yamhill River direct to mains. Chairman Water Board, CHARLES GEISSEN.

Weston, Ore.—The new works have been completed. John Corkish, of Portland, was the contractor. Estimated cost, $10,000.

Grant's Pass, Ore.—ROBERT G. SMITH sends us the following:

The Grant's Pass Water, Light & Power Co. will begin the construction of works about Nov. 1. The supply will be pumped from Rogue River to a reservoir. Estimated cost, $26,500. President, J. W. HOWARD; Secretary, ARTHUR CONKLIN. Population, 1,500.

Fresno, Cal.—A company has been organized with a capital stock of $100,000. Its object is to bring 200 ft. of water from mountain streams and storage reservoirs in the Sierra Nevada Mountains to the plains northeast of Fresno, in the Big Dry Creek section. Part of the water will be brought down in a flume.

Ukiah, Col.—George L. Henzel and P. Maroni, of San Francisco, and Alfred V. La Motte, of Glen Ellen, have purchased land 7 miles from the town, with the intention of putting in an electrical plant for transmitting the motive power for supplying the town with water for domestic use and fire protection. Hydrants will be used.

CANADA.

Moncton, N. B.—A scarcity of water is reported.

Montreal, P. Q.—The enlargement and general improvement of the city's plant is being considered.

Kingston, Ont.—It is proposed to expend $25,000 for extensions.

West Toronto Junction, Ont.—The town has voted to issue $25,000 of bonds for constructing works.

St. Thomas, Ont.—The city is experimenting with a filter from the National Filter Co., of New York, to purify its water.

Calgary, N. W. Ter.—We have received the following from G. C. KING:

The Town Council has extended the time for completing the works to Aug. 1, 1890. Work will be commenced about April 1, by the Calgary Gas & Water-Works Co. Estimated cost $100,000. Water will be pumped from a river to a reservoir. Mr. KEEFER, of Ottawa, is the Engineer.

IRRIGATION.

Las Vegas, N. M.—The Onava Canal & Water Storage Co. has been incorporated at Santa Fé. The incorporators are: EDWARD F. HOBART and JOHN ROBERTSON of Santa Fé; H. GEIST, JAMES FRASER and CHAS. W. WRIGHT, of Las Vegas. Capital stock, $100,000. The object of the corporation is to build canals and reservoirs on the Sapello river, and other streams, in San Miguel Co., and elsewhere.

Santa Fé, N. M.—The contract for constructing the El Paso Irrigation Co.'s canal has been awarded to the Rosenfeld Construction Co., of Denver, Col., at $90,000. The contractors agree to complete the canal, with all head gates, wings, dams, ditches, etc., and are to receive in return $35,000 in cash, and the remainder in 8 per cent. mortgage bonds. The canal runs from El Paso to Fabena, about 31 miles. It will be 4½ ft. deep and 30 ft. wide. The citizens are circulating a petition to raise $3,000 for securing irrigation from artesian wells for neighboring land.

Tularosa, N. M.—The Tularosa Irrigation Co. has been incorporated at Santa Fe by MOSES WILEY, GEO. W MAXWELL, W. S. SHEPERD, E. B. HOMAN, and W. E. PITT, of Dona Ana County. Capital stock, $250,000. Canals and reservoirs will be built on Tularosa Creek and in the White and Sacremento mountains.

Oroville, Cal.—The citizens are talking of giving a bonus of $100,000 to the Big Bend Co. whenever they will bring water from the mountains to irrigate the fruit lands near town.

Denver, Col.—Articles of incorporation of the Lone Cone Ditch Co. have been filed with the Secretary of State. The object of the company is to construct canals and ditches for the purpose of irrigating the land owned by said company in San Miguel county. The capital stock is $9,000, divided into 360 shares.

ARTESIAN WELLS.

Yankton, Dak.—Bids are wanted by the City Council for sinking an 8-in. well.

West Rome, Ga.—A well is soon to be bored.

San Diego, Tex.—N. G. Collins has contracted for sinking a well on his ranch.

ANNUAL REPORTS.

Receipt of the following reports is acknowledged:

Massachusetts.—Brookline., F. F. FORBES, Superintendent.—South Adams, DANL. UPTON, Clerk.

New Brunswick.—Saint John and Portland, GILBERT MURDOCH, Superintendent.